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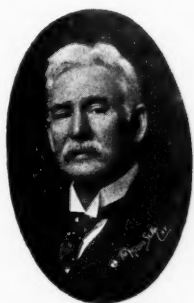
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THE DISPOSAL OF MUNICIPAL WASTE *

Systems and Methods, with Special Reference to American Conditions

By Wm. F. Morse, Sanitary Engineer, New York



WM. F. MORSE.

THE production of waste and effete matter is the penalty of living. Everything that enters into the life of the person, which by assimilation sustains Nature, or which becomes a part of his environment, is subject to change and gradual process of decay, and must be removed, since its accumulation will inevitably produce annoyance, discomfort and insanitary conditions tending to shorten life.

If this be true of individual cases, it applies still more when individuals are gathered into families and communities and the larger associations of towns and cities; hence, the need for cleanliness, as applied to the whole body politic, becomes still more imperative for the common protection.

Taking the family as the unit of communal life, there was at first no trouble in the disposal of waste matters; as the community increased in numbers, the primitive methods of dealing with effete matter, used by the individual and the family, were extended and enlarged to meet the increased production. The garbage was fed to swine or dumped on the nearest vacant ground, into adjacent swamps or ravines, or thrown into the nearest stream or ocean bay. No particular care or oversight was exercised; none was at first thought to be needed, the chief purpose being to get the material out of sight, if possible out of mind, at the least cost and trouble.

FEEDING TO SWINE

In the rural districts and smaller towns, each family kept a pig, raised on the family swill and slaughtered at the approach of cold weather. As population increased this became objectionable, and the swill was often given away for the cost of removal, and afterwards sold to farmers as food for stock. As the municipalities became alive to the need for public collection and removal, they arranged with contractors for its regular collection, or

allowed these to make private terms with the individual citizen. This was almost the universal custom in New England towns and is still the method there most commonly used. Up to 1884, Boston sold the whole of its swill collection for delivery by wagon and train to farmers in Massachusetts, New Hampshire and Vermont. With the exception of the four years, 1890-94, Providence, R. I., has always sold its garbage, as do Pawtucket, Fall River, Taunton, Brockton, Newton, Cambridge, Brookline, Somerville, Malden, Lynn, Lawrence, Salem, Haverhill, Chelsea, Lowell, Springfield, Holyoke, New Haven, New Britain, and many smaller places. Several of the Western cities—St. Paul, Denver, Omaha, Saginaw, Bay City, Superior, Cedar Rapids—continue this custom. The city of Worcester, Mass., maintains a municipal hog-farm, from which it derives a very considerable revenue. In 1903 the return from the sale of pork, pigs, tallow, etc., was \$11,941. The cost of collection was \$18,140. The appropriation from the city was \$6,000, which represents the net cost of collection and disposal for the year.

This custom of feeding is advocated by some health officials as being economical, "not more objectionable than some methods of reduction or cremation" and capable of being "carried on with profit, and very little or no nuisance, if proper attention be given to transportation



FIG. 1.—A PHILADELPHIA REFUSE DUMP

* The first of a series of articles to be published in the large monthly issue of THE MUNICIPAL JOURNAL AND ENGINEER. The second article will appear March 7.

and feeding." The cost at Providence for collection and removal of garbage has averaged, for thirteen years, 15½ cents per capita per annum. In other towns the profit from the sale of garbage or from the sale of swine fed by the contractor, reduces the cost of collection one-third to one-half.

But there are some drawbacks to this admittedly economical system. Milk from badly nourished cows fed on swill is poor in quality, often offensive to taste and smell, and is condemned by nearly every health authority. Garbage-fed pork is liable to trichinosis, as shown by the reports of the Massachusetts State Board of Health (1889) when thirteen per cent. of hogs fed on the public garbage of Boston were subject to this disease, a far larger proportion than is found in Western swine. The dumping of municipal garbage in large amounts on open ground for feeding is attended with consequences objectionable in the highest degree. No one who has been at these feeding grounds in hot weather, and seen the process, can say it is sanitary. The clouds of flies and insects, the multiplied streams of the lowest forms of animal life radiating from heaps of fermenting swill, the nauseating odors arising from the polluted, trampled ground, all unite to create nuisance. It has sometimes happened that epidemics of hog cholera sweep away the whole herd, entailing expense for their disposal and renewal.

The chief claim for this means of disposal is on the score of economy, since it appears to be almost the only way as yet devised by which a town can recover some return for the outlay for collection and disposal. The foremost advocate for this method, after stating the arguments for and against the practice, says, "By this attempt to minimize the evil of the disposal of garbage by feeding to swine, the writer does not intend to maintain that it is a desirable method, and would simply venture the opinion that, under certain conditions, it is not a very bad method."

The smaller cities are not alone in this way of treatment. The large hotels and restaurants of New York City sell their garbage to private parties as food for stock. The collection is made, under permit from the Health Department, in barrels conveyed in large covered watertight wagons, an empty barrel being left to take the place of each full one removed. All collections are made at night or in the early morning hours. The swill is emptied into large kettles, where it is cooked for twenty-four hours, or until the return of the wagons on the following day. The grease rising to the top is skimmed off, pressed, and run into barrels for sale, the remaining contents being fed to pigs or cattle, mixed for the latter with hay or bran. This cooking is essential to fit the swill for feeding. Formerly, the high price of grease yielded a profit from this source alone, but at 2½ cents per pound it is claimed that the grease product fails to pay the cost of the coal burned. The quantity of garbage thus treated is estimated at 50,000 tons per year.

THE INDIVIDUAL METHOD OF DISPOSAL

Those who pay any attention to the subject are familiar with garbage dumps in all stages of beginning, growth

and completion, since there is no release from the ever present evil. In the early days of any town, the vacant lots in the suburbs are garnished with all sorts of refuse matter until some strong objection is made by the property owner. As the town grows, this refuse is consolidated at convenient points where low ground offers an excuse or roads need to be raised in grade. The dumps then include putrescible matter which under the hot sun of summer gives out noxious odors. A ravine or valley on the line of a small stream becomes a favorite place of deposit, or ground excavated for clay, gravel or stone offers a favorable point because a large quantity can be disposed of on a small area. The cartmen, being under no restriction, select the nearest place to dump their loads,



FIG. 2.—RECOVERED MATERIAL AT A PHILADELPHIA REFUSE DUMP

where there is least trouble or objection. Sometimes ashes or earth covers the surface, but as it is nobody's business to see that the dumps are kept covered, nobody cares much for the consequences.

THE LICENSE SYSTEM

Under pressure of complaints and with an increasing knowledge of better sanitary conditions, the town authorities prohibit the dumping of putrescible matters, place the service under inspection of the Health Department, and license certain cartmen to collect and remove the waste. It is usually made obligatory to employ these men, the cost of the work being paid by the individual householder according to the objectionable character of the waste, the quantity, and the distance it must be hauled for dumping. As the population increases, the expenses rise. If there are no sewers, the night-soil collection and removal adds to the burden. Those who are ready and willing to encourage civic cleanliness are, in a sense, compelled to pay for the whole, for many refuse to avail themselves of a service which should be employed by all. The dumps are often a serious interference with the rights of adjoining property holders, and further removal from the town entails more cost for service and inspection. The number of collectors increases, it is difficult to establish and maintain a satisfactory standard for equipment of carts and apparatus, and as the town continues to grow, this service becomes unwieldy and unsatisfactory.

THE CONTRACT SYSTEM

Succeeding the system by licensed collectors comes the

method of collection and disposal of city wastes by contract for a specific term. This may include the whole or a part of the waste; usually it includes the garbage only, leaving the ashes and rubbish to be dealt with by the licensed men or by private contract.

The service is performed daily, or every other day, for the thickly settled part of the town, and bi-weekly for the remainder. The contract provides for a standard equipment of carts, to be kept clean, the collection to be made without nuisance, the disposal to be at places designated, or by satisfactory apparatus.

One city, San Francisco, granted in 1896, for a term of fifty years, a franchise for the disposal of garbage, ashes and refuse by cremation, the material not including night-soil or street sweepings. Oakland, Cal., granted a franchise for the collection and disposal of its garbage for a term of twenty years, also by cremation.

The contract system is the most convenient way for the authorities, but less efficient than the municipal service. Under stress of competition, the contractor is often compelled to work for a small margin of profit, yielding poor service and giving rise to complaints. There is, in fact, but a limited responsibility, the contractor seeking to do the least possible work for the greatest payment. But this is often the only way the work can be done, and when performed under vigilant inspection and rigid enforcement of terms of contract, good service can be secured.

THE MUNICIPAL SYSTEM

In this case the town does all the work with its own equipment and employees. The preliminary expenses are large, but the force can often be used for other municipal work, dividing the cost. The responsibility for cleanly work is better defined, complaints are more promptly attended to, and with good executive officers the employees can be brought to take pride in their work and give the most efficient service. While most of the larger cities and towns have municipal service, and many smaller ones the contract or licensed methods, most places still use the primitive ways of treating waste. There is no rule of general application to methods of waste collection, but there is an evident preference for the municipal system if it can be had at not too great a cost. One eminent authority says: "There appears to be a well nigh unanimous demand on the part of Health officers, and oftentimes of the public generally, for the municipal collection of garbage." If municipal ownership be of advantage in other civic departments, it certainly should be in this, so intimately connected as it is with the health and comfort of the public.

TIPPING INTO WATER

Towns on the seaboard, that could conveniently do so, formerly dumped everything overboard, regardless of consequences. New York City for many years sent outside the Harbor thousands of tons of waste which ultimately floated to neighboring shores and gave rise to endless complaints. This was stopped, in part, by Col. Waring, and later wholly ceased under the present Commissioner of Street Cleaning, Dr. Woodbury. The garbage is now reduced at the Barren Island plant, of the Sanitary Reduction Company, the ashes and street sweepings being

deposited behind bulkheads at Riker's Island and the rubbish partly sorted out and burned and partly dumped with the ashes. With few exceptions, all the northern seaboard towns now deal with their wastes on their own land. But Newport and Lynn send their garbage to sea, and Boston annually deposits outside its harbor 122,000 loads of ashes and street sweepings.

Many of the inland cities on the great rivers continue to use the primitive method of stream dumping. A report made by the Health Commissioner of a Western city, some years ago, gave figures of startling magnitude. According to this "eight cities dumped into the Mississippi River, 152,675 tons of garbage, manure and offal, 108,250 tons of night-soil and 3,765 animals. Four cities on the Missouri River discharged 36,110 tons of garbage, 22,400 tons of night-soil and 31,160 dead animals. Five cities on the Ohio River dumped 46,700 tons of garbage, 21,150 tons of night-soil and 5,100 dead animals."

The present situation on the great rivers is somewhat improved, but St. Louis still continues to dump annually 179,000 loads of rubbish and street dirt into the river; while many towns use the Mississippi and Missouri rivers as a common receptacle for all wastes. New Orleans discharges all its waste into the river, but there are no cities below it to receive the doubtful benefit of this proceeding.

The General Government has published a digest of the laws* forbidding the pollution of inland waters, which may be studied with advantage. The book is a comprehensive review of all State laws on the subject, with citation of cases and authorities. The principles laid down are briefly:

a. "No riparian owner of a stream may appropriate all the water that comes to him, neither may he so corrupt or pollute it as to injure the other owners by diminishing the value of their property in the natural stream."

b. "Whenever the pollution of a stream or other body of water injuriously affects the health, or materially interferes with the peace and comfort of a large and indefinite number of people in the neighborhood, such pollution becomes what is known as a public nuisance. . . . When there is a public nuisance caused by the pollution of water, it is the duty of public authorities to cause its abatement, and their right to do so has been sustained in numerous cases."

c. "Where municipalities are expressly authorized by statute to construct a system of sewerage, and to cause the sewage matter to be discharged into any particular waters, the statutory authority is to be so exercised, subject to the implied condition that such discharge will not constitute a nuisance."

d. "Speaking generally, jurisdiction over the pollution of waters in the United States is confined to the several States, except so far as such powers are restricted by the National constitution or expressly delegated thereby to the General Government."

This subject of water pollution is attracting general attention, notably in New Jersey, where the Passaic Valley

* Department of the Interior, U. S. Geological Survey; Water Supply No. 152, 1905.

Sewage Commission is about to report, and in the case of Illinois *vs.* Missouri, regarding the Chicago Drainage Canal, not yet decided.

STATISTICS OF GARBAGE COLLECTION AND DISPOSAL

Several attempts have been made to collect statistics on waste collection and disposal, but all have met with very indifferent success. The records of most American towns on this subject are incomplete and badly kept. No standard of measurement is taken for a basis, the vague report of so many cartloads being usually considered sufficient; there are few reports of cart capacity and no knowledge of the average weights at different seasons of the year; the weights and volume of different classes of waste are not separately tabulated. The percentage of moisture in garbage, of unburned coal in ashes, of saleable paper and rags in refuse, and of the proportion of manure in street sweepings—all these points must be arrived at by comparison with the returns and reports from one or two large cities. Manifestly conditions and surroundings in different places vary widely, and each individual place should have its own system of records, with a basis for measurement common to all.

In 1902 an inquiry was made by Messrs. Winslow & Hansen, of the Massachusetts Institute of Technology, into the general facts of garbage collection and disposal in 161 representative cities of the United States. These range in population from 28,000 up to the largest, situate in all parts of the country, and include the most progressive and active as well as some of the least enterprising. The reports include the figures for collection service separated from other matters, as follows:

| Methods of Garbage Collection. | Number of Cities |
|----------------------------------|------------------|
| Municipal Collection System..... | 54 |
| Contract Collection System | 48 |
| Private Parties | 41 |
| No Systematic Collection | 12 |
| Not Reported | 6 |
| | — |
| | 161 |

It is understood that the term "private parties" includes the collection by the individual and license system, as opposed to contract and municipal methods. The statement in the paper of the authors is that out of 155 places twenty-nine have no systematic method; in 146 places reporting on collection method, sixty-one adopt the municipal plan, and in eighty-five the work is done by contractors. Almost universally, the ashes are dumped on low ground or used for filling, but in a few cases they are dumped, in whole or in part, into the nearest water. Rubbish is dumped with ashes in seventy-four places, burned on the ground in twenty-six, cremated in furnaces or utilized in nineteen, and thrown into water in six. The means of garbage disposal are thus stated:

| | |
|-----------------------------|----|
| Dumping on land | 44 |
| Burning in dumps | 9 |
| Dumping in water | 14 |
| Ploughing into ground | 18 |
| Feeding to stock | 41 |
| Cremation in furnaces | 27 |

| | |
|--------------------------------|----|
| Reduction or utilization | 19 |
| Irregular disposition | 11 |

NOTE.—In several places different methods are used in different parts of the same city. Thus, in Boston 49,000 tons are delivered to a Reduction Company and 15,000 are taken away by contractors and presumably fed to swine or dumped with ashes and refuse on land.

It would appear, from this report, that the primitive methods are still the most popular; as out of 161 places only 102, or 63 per cent., have any systematic methods for collection, and out of 147 reporting on methods of disposal only forty-six, or less than one-third, have any improved methods of treatment.

If this be true of 161 places of the best class, it is still more significant when towns smaller in population and of less enterprise in sanitary science are considered.

Mr. M. N. Baker, in the *Municipal Year Book* for 1902, says: "The stubbornness with which most American communities cling to primitive and unsanitary methods of garbage disposal is shown by the fact that only ninety-seven of the 1,524 cities and towns included in the Year Book have reported either garbage cremation or reduction plants."

That is to say, only 6.3 per cent. of the towns of the United States, having a population of 3,000 and upwards, have in fifteen years made any real progress on the lines of enlightened and scientific disposition of the communal wastes. This is not a very encouraging result for the expenditure of time, energy and money in this work, but still it represents progress which, though small in itself, will serve to indicate what will be the future of the work now fairly under way.

INSANITARY CONDITIONS PRODUCED BY DUMPING

The deposit of organic matter in thin layers upon ground fully exposed to the salutary influences of light and air is far more sanitary than when the putrescible waste is buried in mass. Decomposition in the open air proceeds rapidly by the propagation of aerobic bacteria which, assisted by the absorbent action of the earth, resolve the compounds into simpler forms, while the disengaged gases are oxidized by the air.

But when deposited in masses and covered, the chemical changes are produced by anaerobic organisms only, the released gases are greater in volume and more concentrated, with intensely disagreeable odors, and these find exit through the adjacent soil. Even when mixed with ashes the putrescible matter is not rapidly changed, but continues in a putrefactive state for long periods. Many instances are reported of the presence of organic matter in offensive and dangerous forms, though years have passed since its deposit.

When ground made by such methods is covered by buildings, the health of the occupants is endangered. The statement made to the writer by the Health Commissioner of one of our large cities was that the continued presence of cases of diphtheria and scarlet fever in houses standing on ground filled with waste was undoubtedly due to the insanitary conditions of the foundations. These diseases followed the line of previous waste dumping, while adjoining dwellings on original ground were comparatively free.

Dr. Ezra Hunt, of the State Board of Health of New Jersey, says:

"Whole groups of zymotic diseases are traceable to ground conditions. When, as in some parts, soils are composed of an accumulation of decaying matters or of foul material removed from the streets, the building of houses over it may conceal but cannot destroy the contamination. More or less of the foul air must find its way out of the soil and endanger the health of the people living upon it."

It is stated by some eminent medical men that the continued tipping of refuse near South American cities largely accounts for the yellow fever scourge. That this standing menace to health is now becoming understood is evidenced by the fact that one of the largest South American cities is seeking for means to dispose of 400,000 cubic yards of refuse, the accumulation of centuries, deposited in the immediate vicinity of the city.

It may be said that there is a general consensus of opinion, all over the world, that this practice of tipping organic waste and putrescible matter of any sort upon land or into water, objectionable and filthy in itself and productive of nuisance and obnoxious conditions, will, if continued, cause the inception of certain classes of disease which otherwise would be avoided.

There is an æsthetic side to the question that should be considered—the continued presence of these unsightly heaps of refuse matter on the outskirts of towns is not agreeable to the sight of residents or prospective citizens. Though care be taken to keep dumps covered, there are always floating paper, straw, litter and light particles scattered by the wind that cannot be controlled, and too often the bases of these heaps terminate in stagnant water, formed by the rains percolating through the mass.

REFUSE SORTING AT THE DUMPS

When municipal and private waste taken to dumps contains anything that can be recovered and sold, it is picked out and taken to market. As a rule, the trash collection will have paper of many kinds, books, cardboard, rags, carpets, bagging, clothes, shoes, bottles, iron, and a host

of miscellaneous articles of no service to the original owner, but of some real value when brought together in quantities. When this mixed mass is tipped at the edge of the dump it is pulled apart and sorted by men, often by women and children, who make this their livelihood.

The recovered things, covered with dirt and dust, often saturated with filth, in the last stages of decay or usefulness, are thrown into heaps until enough accumulates for a cartload. The dry paper is roughly baled on the spot; the wet rags and paper are exposed to sun and air for drying; the clothing, bottles, iron, etc., are conveyed back to the town and again sorted and sold for junk. This is done in almost every place where there is a licensed or contract collection service, and many towns having municipal service permit it on condition that the dumps are kept leveled off without expense to the town.

The system has to recommend it only the facts that many poor people get a precarious living, and that contractors recover enough of value to enable them to do the collection work cheaper than they otherwise could. Some large cities sell the rights for picking, and some positively prohibit all sorting, but most pay no attention to the custom and allow its continuance unless complaints be made by adjoining property holders.

The recovery of these articles, as usually carried out, is objectionable for several reasons. It is not sanitary, as all persons connected with it are necessarily exposed to dust, dirt and possible infection from contaminated matters. The recovered portions, again handled in sorting and baling, are in too filthy a condition to be returned to the town. The practice increases the nuisance of the dump, and is a frequent source of complaints. The refuse is not finally disposed of or rendered inoffensive, but becomes subject to further inspection and possible expense.

This recovery of the marketable constituents of refuse, if done at all, should be under municipal oversight and regulation, and the articles saved—the property of the town—should be credited to it as an asset against the expense of the collection service. The agency by which this work can be done in a sanitary and profitable way will be considered later.

THE OHIO ENGINEERING SOCIETY

THE twenty-seventh annual meeting of this society, held at Columbus, January 22-24, was attended by eighty members and nearly two hundred visitors, thirty-seven new members being added to the roll during the meeting.

The following officers were elected for 1906:

President, G. A. McKay, City Engineer and County Surveyor, Xenia; Vice-president, John Laylin, City Engineer and County Surveyor, Norwalk; Secretary-Treasurer, E. G. Bradbury, 85 North High street, Columbus; as Board of Trustees, A. E. Cole, County Surveyor and City Engineer, Marietta; W. C. Wangler, Engineer, Milton Coal Co., Wellston; Prof. J. L. Gilpatrick, Denison University, Granville; Chas. A. Judson, Collector of Customs, Sandusky; J. R. Marker, County Surveyor, Greenville.

A Municipal section was organized, the following being elected officers:

President, R. E. Kline, Dayton; Vice-president, Paul R. Murray, New Philadelphia; Secretary-Treasurer, E. G. Bradbury, Columbus.

Among the proposals of the Special Committee on Legislation, adopted by the meeting, are bills for the establishment of a State Board of Registration and Examination for civil engineers and surveyors, and bills providing for further investigation, by the State Board of Health, of sewage disposal and water purification plants; also for legalizing the use of oil for street and road sprinkling. The matter of stream pollution was referred to a special committee, to confer with committees of other engineering societies.

The papers read included some on municipal topics, which we hope to present to our readers at a later date.

THE TESTING AND USE OF PORTLAND AND NATURAL CEMENTS*

An Expert's Views, with Details and Results of Experiments on Novel Lines

THE present remarkable development in the use of cement is the direct outcome of the careful and persistent observations and experiments of our engineers, mechanical, chemical and civil. There is not a structure of modern times built of natural stone or forms of burned clay that has not been duplicated in cement, and the latter is now meeting structural requirements hitherto impossible except by the use of iron, steel and timber, and its advantages over the latter materials in the matter of cost, durability and freedom from injury by fire and water are only just coming to be known. Time has shown that when cement is carefully selected and treated intelligently in the practical work of construction, enduring monuments are founded to the honor and credit not alone of the designer and builder, but, in justice be it said, to the pioneers and courageous supporters of this important industry in our country, who have persevered in face of many discouraging and adverse conditions until the American product is recognized as standard the world over.

While the rapid growth of the Portland cement industry, since 1895, and the extended use of the material in all forms of construction may well be taken as a tribute to its improvement and reliability, the better understanding and appreciation, not only of users, but of engineers and architects as well, must also be considered of the utmost importance. Hydraulic cements have been made and used for more than a century, and yet it has remained for investigators of comparatively recent years to throw much light upon the subject, and the light must be widely disseminated before the full benefit will be derived.

The adoption of standard specifications for Portland and natural cements, in 1904, by the Joint Committee of the American Society of Civil Engineers and the American Society for Testing Materials has proved a happy issue out of the maze of conflicting requirements imposed upon manufacturers throughout the country in years past. It was perfectly natural, under such conditions, that doubt and suspicion of a product so little known should prevail among the uninformed, and the American manufacturer of Portland cement, the agent for foreign cement as well, was often regarded as a necromancer when he was enabled, through his superior knowledge and experiences, to demonstrate that a particular cement was all right for use. Before the adoption of the standard specifications (and even to-day to some extent), much conflict of opinion was found upon some of the most vital principles governing the acceptance of cement; each tester or engineer performing this duty was a law unto himself, and exercised

the full prerogatives of his official position in fixing requirements and interpreting results, often prescribing misleading and fallacious tests as an indication of quality. These served to vex and hamper the manufacturer and to set an effectual barrier between the very interests which have since combined and co-operated to the great benefit of all concerned.

In the absence of better information, it may be natural for the user of cement to entertain with suspicion the statements of the manufacturer affecting the quality of a cement, but it seems obvious that with standard specifications and uniform methods of testing, combined with full and up-to-date information upon the results of the several determinations made, there would follow greater uniformity in the material, less opportunity for dispute and a greater degree of confidence and mutual respect between men who are seeking the same attainments—excellence of material, design and workmanship, in all projects that mark the prosperity and progress of our country.

With an experience covering nearly eighteen years upon important hydraulic construction, I have found opportunity to observe many variable conditions affecting the requirements and use of cement, and I know of no material entering into construction of which so much is expected, or which is subjected to the same or equal abuses; when a failure is recorded, happily very seldom, how common it is to see it ascribed to the cement.

An idea may obtain in the classroom, office or laboratory which, if carried out or closely approximated in the field, would give excellent results, but how often this is forgotten or overlooked and crude, even cruel methods of work are suffered. This can, under some conditions, be said even of cement-testing. Young men are sometimes selected for this work without previous experience or any knowledge of the subject, and though one may have a high degree of intelligence and be industrious and conscientious in his work, under good or indifferent supervision, yet the best that can be said of such a selection is that it is more likely to lead to a good cement being questioned than to the passing of a poor one, although the latter chance is not remote; meanwhile, little consideration is shown the manufacturer or the reputation of his product.

Once asked to explain the difference in results obtained by two testers working together, using the same amount of water in mixing and following the same method of moulding, etc., I offered the somewhat parallel case of two cooks making bread from the same barrel of flour, the same yeast, and the same formula throughout, and yet the quality and appearance of the loaves would be quite unlike.

The personal equation, perhaps, may not be wholly re-

* Paper read before the National Association of Cement Users, at its Milwaukee Convention, January 9-12, 1906, by E. S. Larned, Civil Engineer, Boston.

movable from cement testing, but other conditions vitally affecting the results can be brought to a more uniform basis. These may be summed up as the quantity of water used to produce a paste or mortar of given consistency, the time and manner of manipulation, the method of moulding, the temperature of water and air, the time and conditions of exposure in air and water, and the rate of applying the load.

When tests are made under the standard specifications by an experienced and skilled operator, they form a record valuable not alone to the work in which the material is being used, but to all users of cement who may have access to the results. Uniform tests, under a standard specification, serve to show:

First—Whether the material meets the standard of fixed requirements.

Second—Uniformity or otherwise of the product tested.

Third—A comparison with other brands of the same material, invaluable when making a selection and computing the real relative net values.

Without a uniform specification and uniform tests thereunder it is obvious that results could give no indication of uniformity of product, and a comparison with other brands, or with the same brand tested at other points, would be meaningless to a great extent. Training and experience are regarded as essential in any technical, mechanical or professional work to produce scientific, accurate and trustworthy results—the operator must know the full significance of his determinations or he will at times omit some details or overlook a precautionary measure which may have a marked effect upon his results. Only trained, experienced men should be intrusted with the testing of cement on important public or private work, where results are carefully tabulated and published in reports or otherwise circulated, and it is of great benefit and interest to all users of cement that they may have such results to refer to. The small or casual user of cement hardly finds it expedient or necessary to attempt a chemical analysis or test for specific gravity, in fact, when he is using a well-known and established brand he need feel little concern about this, and the tests for soundness, sand carrying capacity (which he determines by tensile tests of sand mortars), time of setting and fineness, have a bearing on the chemical proportions and specific gravity meaning much to the experienced observer.

Tensile tests of nest cement are useless in determining the real relative strength of one or several brands of cement; the proportion of one part cement to three parts sand, by weight, should alone be considered in making comparisons. We use the cement with sand, not neat, consequently we want to know what to expect in our work. Many cements, both Portland and natural, give very satisfactory results in the neat test, but show marked inferiority compared with the best brands of both grades when tested for their sand carrying capacity. Unless the standard Ottawa sand or crushed quartz be used throughout the test we must recognize the fact that variable results will follow and that these are not necessarily due to the cement.

The effect of water in retarding the induration of

cement and reducing its tensile strength, particularly at short periods, has long been known, and more or less information has been published as the result of experiments made. The writer was led to make a series of tests on these lines in 1901, in somewhat more detail than anything he had seen published, and it is the result of these that we will now consider. It may be stated that one man made the briquettes for the entire series, six for each period, at each interval in the amount of water used; the water was at a uniform temperature of 63° F. and the temperature of the air averaged slightly under 70°, and fluctuated between 50° and 75°. Two briquettes of A. S.

TABLE SHOWING TENSILE STRENGTH OF CEMENTS MIXED NEAT WITH DIFFERENT PROPORTIONS OF WATER

| Cement brand. | Water per cent. | Sieve test; residue on. | | | Wire; minutes. | | Tensile strength. | | | | | |
|----------------------|-----------------|-------------------------|----------|----------|----------------|--------|-------------------|---------|----------|-----------|-----------|------------|
| | | No. 50. | No. 100. | No. 180. | Light. | Heavy. | 24 hours. | 7 days. | 28 days. | 3 months. | 6 months. | 12 months. |
| | | | | | | | | | | | | |
| "Giant" Portland. | 13 | 0.15 | 5.4 | 21.2 | 12 | 207 | 371 | 655 | 875 | 941 | 720 | 787 |
| | 14 | ... | ... | ... | 21 | 297 | 308 | 750 | 973 | 1008 | 735 | 816 |
| | 15 | ... | ... | ... | 29 | 355 | 260 | 649 | 778 | 831 | 645 | 748 |
| | 16 | ... | ... | ... | 50 | 402 | 238 | 500 | 693 | 716 | 621 | 676 |
| | 18 | ... | ... | ... | 142 | 473 | 184 | 546 | 635 | 601 | 589 | ... |
| | 20 | ... | ... | ... | 268 | 327 | 167 | 539 | 649 | 644 | 629 | 755 |
| "Union" Natural. | 24 | 0.1 | 4.6 | 10.2 | 13 | 32 | 212 | 251 | 252 | 311 | 275 | 358 |
| | 28 | ... | ... | ... | 18 | 39 | 185 | 218 | 215 | 289 | 300 | 341 |
| | 29 | ... | ... | ... | 21 | 42 | 150 | 188 | 220 | 257 | 272 | 314 |
| | 30 | ... | ... | ... | 29 | 52 | 128 | 178 | 202 | 246 | 248 | 256 |
| | 31 | ... | ... | ... | 21 | 57 | 112 | 173 | 199 | 224 | 239 | 309 |
| | 33 | ... | ... | ... | 27 | 85 | 104 | 172 | 182 | 267 | 246 | 290 |
| "Atlas" Portland. | 35 | ... | ... | ... | 38 | 137 | 93 | 121 | 178 | 260 | 286 | 319 |
| | 37 | ... | ... | ... | 34 | 160 | 85 | 108 | 168 | 262 | 306 | 326 |
| | 38 | ... | ... | ... | 67 | 233 | 85 | 119 | 202 | 252 | 371 | 400 |
| | 13 | 0.1 | 7.0 | 18.0 | 13 | 270 | 366 | 775 | 859 | 1067 | 902 | 882 |
| | 14 | ... | ... | ... | 18 | 308 | 404 | 780 | 891 | 972 | 852 | 781 |
| | 15 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| "Hoffman" Rosendale. | 16 | ... | ... | ... | 22 | 327 | 363 | 602 | 725 | 844 | 806 | 723 |
| | 18 | ... | ... | ... | 15 | 383 | 308 | 570 | 723 | 785 | 728 | 724 |
| | 20 | ... | ... | ... | 56 | 703 | 225 | 590 | 718 | 760 | 674 | 636 |
| | 22 | ... | ... | ... | 52 | 833 | 166 | 554 | 649 | 731 | 648 | 604 |
| | 24 | ... | ... | ... | 188 | 918 | 42 | 510 | 691 | 695 | 682 | 574 |
| | 23 | 2.3 | 12.4 | 21.9 | 22 | 59 | 138 | 177 | 271 | 332 | 284 | 264 |
| | 24 | ... | ... | ... | ... | 78 | 125 | 141 | 264 | 342 | 309 | 310 |
| | 25 | ... | ... | ... | 35 | 120 | 150 | 164 | 216 | 308 | 318 | 321 |
| | 27 | ... | ... | ... | 49 | 143 | 117 | 116 | 194 | 305 | 245 | 272 |
| | 29 | ... | ... | ... | 76 | 166 | 96 | 105 | 164 | 272 | 320 | 267 |
| | 31 | ... | ... | ... | 117 | 212 | 72 | 72 | 159 | 270 | 371 | 225 |
| | 33 | ... | ... | ... | 115 | 235 | 62 | 71 | 147 | 277 | 379 | 244 |
| | 35 | ... | ... | ... | 127 | 400 | 50 | 64 | 112 | 245 | 318 | 315 |
| | 37 | ... | ... | ... | 198 | 828 | 59 | 62 | 96 | ... | 284 | 351 |
| | 39 | ... | ... | ... | 260 | 1057 | 54 | 56 | 85 | ... | 355 | 364 |

Results shown are the Averages of six briquettes made.

C. E. standard form were gaged at a time, and, beginning with the dry mixtures, the moulds were filled in three layers, each rammed by hand successively until flushed, using a hard-wood pestle, and finally struck off and smoothed with a trowel. The ramming process continued until the mixtures became too soft, when the moulds were filled by pressing in with the thumb and trowelling. So far as possible, the briquettes were allowed to set in air, under a damp cloth, for about two hours after taking the heavy wire before immersion. This could not be followed uniformly; some of the softer mixtures were allowed to set in air overnight, and in a few instances the operator was obliged to wait late in the night to complete his observations. In determining the rate of setting, the Gilmore needles were used, care being taken to use, throughout the series, the same samples of cement, taken from the storehouse of contractors engaged in the construction of large public works. The decimal scale of weights was used in gauging, the graduated glasses being

calibrated to agree, and the briquettes were broken on a Fairbanks machine of late pattern, the clips having roller bearings of composition metal.

Chemical analyses of the cements here considered were not made for this test, but the characteristics of the brands named are well known to many and will be only briefly referred to. The "Atlas" and "Giant" brands of Portland cement both came from the Lehigh district of Pennsylvania and, in their chemical composition, are in quite close agreement. The "Union" natural is also made from the crystalline cement rock of the Lehigh district, is light in color, and in composition is quite unlike the "Hoffman," which is dark in color, being made from the magnesian limestone of the Rosendale district, New York. "Union" more closely approaches the Portland standard in compo-

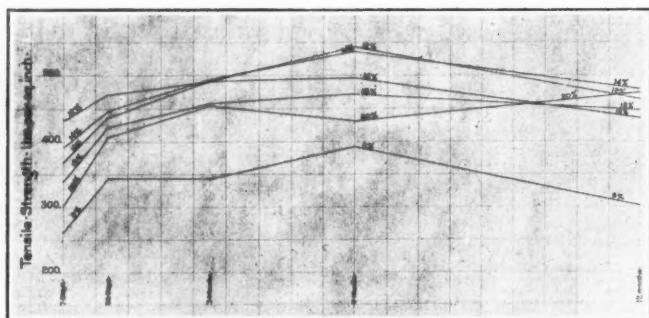


Diagram showing Results of Tests to determine effect on Tensile Strength of Portland Cement Mortar, 2:1, using different percentages of water in gauging.

sition and differs from the "Hoffman" noticeably in its lime and magnesian content, having about 50 per cent. lime and 2 per cent. magnesia, while the "Hoffman" has about 36 per cent. lime and from 16 to 18 per cent. magnesia, this being characteristic of most New York Rosendale cements. The low magnesia content, together with the very fine grinding of "Union," cause it to be more active and quicker setting than "Hoffman." This is well shown in the table and diagram, particularly in the wetter mixtures.

As might be expected, this difference in the cements, tested neat, would be in still greater contrast when combined with sand in concrete mixtures, and it was, in fact, the dissimilar results in the practical work of construction that led to this experiment. I regret that it did not include mortar mixtures, in the proportion of two sand to one cement, in the natural cement, and three sand to one cement for the Portland, wherein conditions would obtain more closely approximating the operations of everyday practice.

From personal acquaintance with a recent large work of concrete construction, I was forced to the conclusion that when any reliance must be placed upon the cohesive strength of Rosendale cement, within six months and perhaps longer, depending upon the exposure

and local conditions, great care must be exercised in proportioning the amount of water used, or, in the present day of wet concretes, in selecting a cement that successfully withstands the deteriorating influence of an excessive amount of water.

In the diagram of tensile results, the dryer "Hoffman" mixtures show superiority up to the 28-day period, at which time it is quite marked and uniform; the gain in strength between the 24-hour and 7-day periods appears slow, and grows slower as the amount of water is increased; the improvement between the 7-day and 28-day periods is greater, but the rate of gain appears generally in favor of the dryer mixtures; the gain in all mixtures between this and the three months' period appears quite uniform, and develops a rapid gain for the wetter mixtures. After the latter period inconsistencies develop, and between six months and one year only the 37 per cent. and the 39 per cent. series show any appreciable gain, while the wettest mixture appears superior at the end of the year, the others generally showing a falling off in strength, for which I can offer no explanation.

In the "Union" cement series the dry mixtures generally appear superior at the 24-hour and 7-day periods, the rate of gain is quicker and quite uniform; as in the Portland cements, the gain in strength of the wetter mixtures is more rapid between 7 days and 28 days, the wettest mixture having passed four of the series next below, and all of the series being closer together than at the two earliest periods; at three months only the 23 per cent. and 25 per cent. series held their superiority, the wetter mixtures rapidly overtaking all others and being in close agreement, with the exception of the 31 per cent. series, which made a slower gain; after this period peculiarities develop for which no explanation can be offered, but the uniform rate of improvement is noticeable in all instances. The results at one year are better in each case than at any preceding period, the 23 per cent. and 33 per cent. series showing a falling off between three months and six months, with a good recovery at one year.

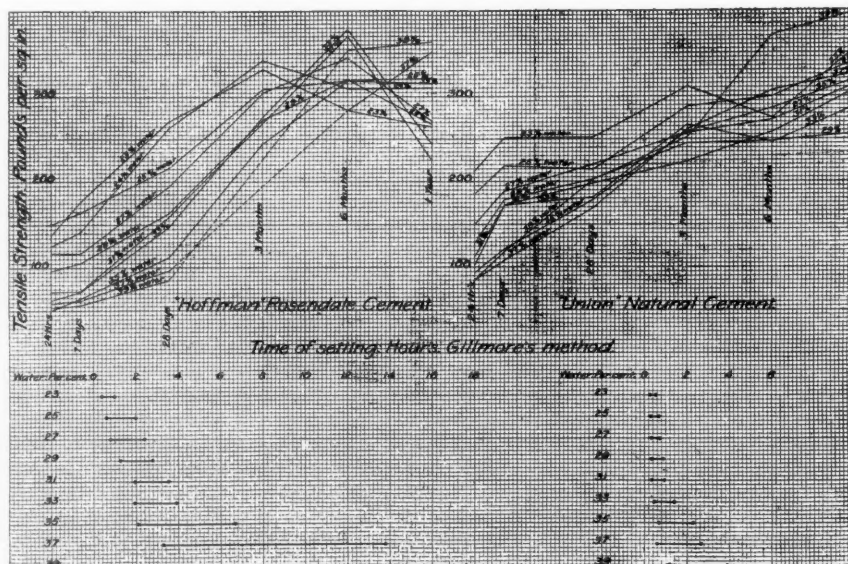


Diagram showing Tensile Strength and Rate of Setting of Natural Cement, mixed neat with different proportions of water.

In the Portland cement series the rapid and uniform improvement between 24 hours and 7 days is noticeable, but the dryer mixtures generally hold their superiority. This is noticeably uniform in the "Atlas" cement at all periods. The maximum strength was attained at three months, after which, and up to one year, there appears a steady falling off in strength, but from three months on the dryer mixtures are uniformly better.

The "Giant" cement also attained its maximum strength at three months, at which period the dryer mixtures also appear uniformly superior with the exception of the 15 per cent. series; and, judging from the results of this series throughout the test, it would appear that there was not quite enough water used to perfect the crystallization of the cement. The "Giant" cement also shows a falling off between three months and six months, but a good recovery after this latter period in all but one series, 22 per cent. The wettest mixture, 24 per cent., passed the three series next below at one year, two of them in fact in six months, and between six months and one year it showed a more rapid gain than any of the other series.

The personal equation is apparent in these tests, as in any test of the tensile strength of cements, but every effort was made to secure consistent and uniform results, and I will repeat that one man made the test throughout the entire series for the four cements named.

Cement or concrete construction, with or without steel reinforcement, is coming rapidly into favor, supplanting steel, stone, brick and lumber in all forms of construction, and it is but natural that mistakes and failures sometimes attend the efforts of the inexperienced. Certain retribution is in store for dishonest workers, but it is a remarkable tribute to this comparatively new material that so few failures have been recorded during the phenomenal growth of the industry. In fact, the failures in brick, timber and steel frame structures are more numerous than in concrete construction, and yet all are chargeable to carelessness or dishonesty; let us hope that each will serve as a beacon light to prevent a like calamity in the future.

Low first cost is not necessarily ultimate economy; if concrete did not perform its duty well and stand the test of time other materials would surely supersede it. It is of the greatest commercial importance to all in the industry that quality be a first consideration; you well know how the slightest imperfection in concrete work is pointed to by hostile interests as a sign of inferiority or failure, and a small crack which would be overlooked in brick work is viewed by the uninformed as a forerunner of sure and sudden collapse. Use only high-grade cement, select your sand with care and beware of sand containing loam and clay; clean siliceous sand ranging from fine to coarse gives the best results—test it in combination with your cement before

using. The ballast or coarse aggregate should also be clean, and of varying size in order to reduce the voids to a minimum. Gravel and igneous rocks furnish the best stone for concrete, much better than limestone for fireproof construction. For crushed stone, use a $\frac{1}{4}$ -inch mesh dust jacket on the sizing screen, you will then have a more uniform product. The amount of dust varies with the size, shape and character of the stone crushed, also with the rate of feed into the crusher, the speed of the crusher and the degree of moisture in the stone. Stone dust, if clean, is better than almost any sand, but should be accurately gaged as sand, and more care is required to thoroughly incorporate it with cement because of the large percentage of fine material contained.

If crushed stone is stored or binned, as in most work requiring reserve stock, a more uniform mixture can be drawn from the bins, when using, if the dust be excluded; the latter serves to pack or cement the stone together and alternating loads of coarse and fine will surely result.

In securing quality, thoroughness and care of mixing and placing concrete are of the utmost importance; carelessness in placing will undo the work of mixing.

Proportions of cement, sand and stone will vary, depending upon the work to be done, but it is well to keep in mind:

First—That the stone voids should be a little more than filled with sand, and the sand voids a little more than filled with cement, if strength is desired.

Second—That the voids in ordinary sand vary from 30 to 42 per cent., so that if leaner proportions than one part cement to three parts sand be used the cement will not fill the voids and the mortar will be porous.

Third—Accurate gaging is essential to uniform results.

A word as to consistency, i. e., amount of water used: Wet concrete is the order of the day, and while I be-

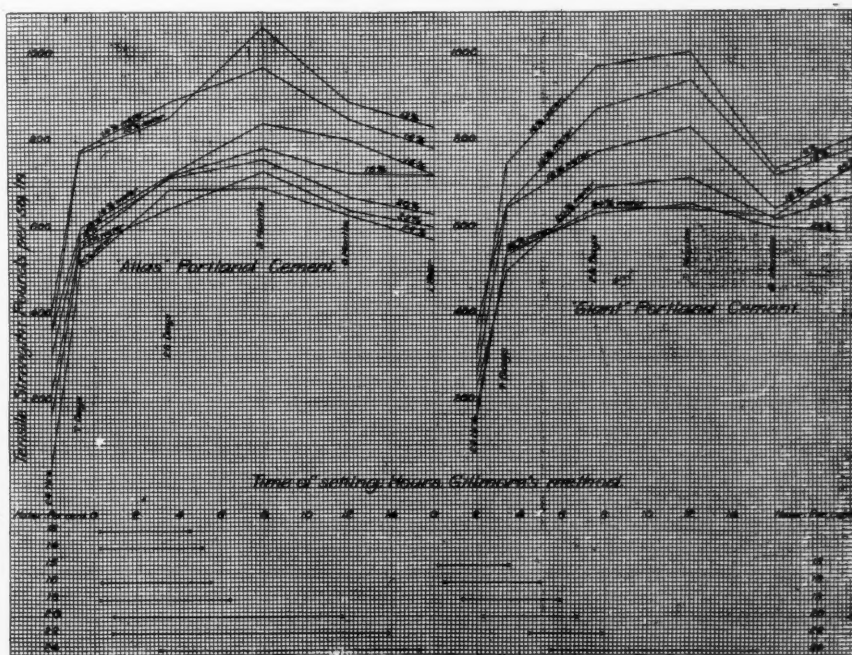


Diagram showing Tensile Strength and Rate of Setting of Portland Cement, mixed neat with different proportions of water.

lieve in using too much rather than too little water, still, in my judgment, much concrete is made too wet, and if in this condition much tamping, spading or forking be done, the coarse aggregate will be driven to the bottom of each layer placed and a very unequal distribution of cement throughout the mass will follow. Except in the presence of very intricate reinforcement, the mortar should be of a consistency that will easily support the coarse aggregate and admit of light tamping. Excess of water serves to undo the work of thorough mixing.

With the view of determining the variability of wet mixtures, I made the following test last year:

Gang moulds were placed vertically over each other, eight in all, to represent a layer eight inches deep, the joints between moulds being sealed with a thin layer of a mixture of white wax and tallow to prevent the escape of water. A high grade Pennsylvania Portland cement was used in the proportion of 1 part cement to 3 parts of standard Ottawa sand, by weight, gaged with 20 per cent. of water. Fine annealed wires (32 gauge) were inserted between the moulds, and when the mixture had partially set these were used to cut the moulds apart, and the operation was satisfactory in producing perfectly formed briquettes. The briquettes were allowed to remain in the moulds over night, under a damp cloth, and were then removed and immersed in water until broken.

The consistency of this mortar compares closely with much of the wet concrete now used, dryer than some I have seen used in large work. When the moulds were filled the mixture was churned and worked with a glass

rod about $\frac{1}{4}$ -inch in diameter. The following results are the average of three briquettes, a total of forty-eight being in the series. No. 1 briquette is from the top layer and No. 8 from the bottom.

tom layers is clearly apparent, there being a maximum loss in strength of 117 pounds at 28 days and 151 pounds at 45 days.

It would appear entirely reasonable to assume that a greater variation would be found in a seven-day test than in either of the above two noted. Concrete to be of the utmost value should be a true monolith of uniform strength throughout; this is of vital importance in beam, girder and slab construction and is not difficult of attainment.

This would seem to suggest that the idea is worthy of serious consideration, and further experiment, in the line of compression tests also, may bring forth interesting facts.

Another tabulation is also given showing the tensile strength of Portland cement mortar mixed in the proportion of one part cement to two parts sand and gauged with different percentages of water, ranging from 8 to 20 per cent.

Sand known locally as "Plum Island" sand was used. This is a dredged sand, very clean, selling at \$1.60 per ton delivered. High grade Pennsylvania cement was used. The results given are the average of three briquettes. The percentage of water used was determined on the combined weight of cement and sand. Briquettes were immersed in water until broken after remaining in a moist air closet twenty-four hours.

The injurious effect of using too little water is plainly evident in the 8 per cent. series and requires no further emphasis. Up to six months the superiority of the dryer mixtures, excluding the 8 per cent. series, is quite uniform, and it would appear that from 12 to 15 per cent. of water would give the best results in a mortar of this composition, namely, 1 part cement to 2 parts sand; 14 per cent. of water will yield a very plastic mortar if properly tempered.

Tensile Test of Portland Cement.
Mortar 1 Cement: 3 Sand.
Gaged with 20 Per Cent Water.

| Number of Small Briquettes into which Large Briquette was Cut by passing fine wire between small molds. | 28 Days. | | 45 Days. | |
|---|----------|--------|----------|--------|
| | Top | Bottom | Top | Bottom |
| 1 | 336. " " | No. 1. | 386. " " | |
| 2 | 288. " " | 2. | 392. " " | |
| 3 | 225. " " | 3. | 354. " " | |
| 4 | 255. " " | 4. | 318. " " | |
| 5 | 222. " " | 5. | 292. " " | |
| 6 | 219. " " | 6. | 289. " " | |
| 7 | 288. " " | 7. | 241. " " | |
| 8 | 303. " " | 8. | 265. " " | |

rod about $\frac{1}{4}$ -inch in diameter. The following results are the average of three briquettes, a total of forty-eight being in the series. No. 1 briquette is from the top layer and No. 8 from the bottom.

The purpose of this experiment would have been accomplished in the test for one period alone, but it was deemed inexpedient to make the trial for any time short of one month. The inferiority of the briquettes in the bot-

PORTLAND CEMENT MORTAR, 1 CEMENT TO 2 SAND.

| Time of Test. | Tensile Strength, pounds per square inch. | | | | | |
|---------------------|---|-----|-----|-----|-----|-----|
| | Water—per cent. | 8 | 12 | 14 | 16 | 18 |
| 7 days | 261 | 433 | 392 | 368 | 338 | 301 |
| 28 days | 344 | 470 | 447 | 436 | 422 | 407 |
| 3 months | 344 | 490 | 494 | 491 | 457 | 454 |
| 6 months | 392 | 543 | 536 | 497 | 472 | 430 |
| 12 months | 300 | 463 | 478 | 434 | 446 | 474 |

It is gratifying to note the growing appreciation of the important part sand plays in all cement work; in very many instances poor results are directly chargeable to the sand used. No cement will improve properly if mixed with very fine sand, and results will vary with the characteristics of the fine material. It must also be kept in mind that an intimate mixture of cement and fine sand is very difficult to attain, and a thorough distribution of cement throughout the sand voids is absolutely essential to good results.

Sand that looks good is not always above suspicion; the following instance will serve to show the importance

of testing the sand before use. An important hydraulic work was begun last spring in New Brunswick and the contractors and engineers had congratulated themselves upon having what appeared to be an ideal deposit of sand and gravel for concrete work. The cement was thoroughly tested with standard sand, with good results. When everything was ready an active start was made and considerable concrete was placed before any doubts arose; it would not set up, however, in a week's time (or longer, as it proved) and the cement was immediately tested again, with favorable results, and then some of the sand was examined. On the washing test it was noticed that a slight opalescence was imparted to the water, remaining in suspension several days, but leaving practically no deposit on sedimentation. The cement was then tested with this sand before and after washing, and the trouble was at once located. The sand and gravel were both washed thereafter, and good results followed.

A tabulation is added showing the tensile strength of cement mortars in the proportion of one part of sand to one of cement, by weight, for Rosendale or natural cements, and two parts sand to one part cement for the Portland. A siliceous sand was selected for this test, carefully screened to the sizes noted and combined in the

that contains 5 per cent. dust, and a good deal that carries as much as 10 per cent., and even more in some instances.

The fine material passing the No. 100 mesh screen, used in this test, was obtained from a clean, white siliceous sand, and if, with increasing amounts of this material, a falling off in tensile results appears, it can in no sense be taken as a measure of what would follow by using sand containing a dust of loamy or clayey nature, but is in a way suggestive. The cements used in this test were of the same sample as in the other tests previously referred to.

The sand mortar test is the true basis upon which to judge the value of a cement, and I believe the proportion of sand to cement should be the same as employed in the actual work of construction. Unfortunately, this was not carried out in the above test of the natural cements, for the reason that results were desired, for purposes of comparison, with previous tests in the same laboratory, in which crushed quartz or standard sand was used in the proportion of one part sand to one of cement.

Explanation of the results is hardly required; it will be noticed, particularly in the natural cements, how uniform and constant is the falling off in strength at the 7-day period, as the amount of fine material increased.

TENSILE STRENGTH OF CEMENT MORTAR WITH SAND GRAINS OF DIFFERENT DIAMETERS. RESULTS SHOWN ARE THE AVERAGE OF SIX BRIQUETTES MADE

| Sand gauge per cent. used. | | | | Natural cement mortar 1:1. | | | | | | Portland mortar 2:1. | | | | | |
|----------------------------|-----------------|----------|-------|----------------------------|----------|----------|--------------|-----------------|------------|----------------------|--------------|-----------------|----------|----------|--------------|
| No. 30. | No. 20. | No. 100. | Fine | Water per cent. | "Union." | | | Water per cent. | "Hoffman." | | | Water per cent. | "Giant." | | |
| | | | | | 7 days. | 28 days. | 6 mos. | | 7 days. | 28 days. | 6 mos. | | 7 days. | 28 days. | 6 mos. |
| 100 | ... | ... | ... | 17 | 156 | 193 | 352 | 25 | 115 | 163 | 314 | 10 1/2 | 286 | 258 | 412 |
| ... | 100 | ... | ... | 17 | 151 | 194 | 349 | 15 | 118 | 146 | 286 | 10 1/2 | 294 | 331 | 473 |
| ... | ... | 100 | ... | 17 | 153 | 187 | 340 | 15 | 91 | 110 | 257 | 10 1/2 | 201 | 226 | 294 |
| ... | ... | ... | 100 | 17 | 100 | 123 | 307 | 15 | 71 | 76 | 186 | 10 1/2 | 129 | 159 | 223 |
| 80 | 10 | 10 | ... | 17 | 154 | 210 | 358 | 15 | 94 | 124 | 301 | 10 1/2 | 361 | 390 | 486 |
| 70 | 15 | 12 1/4 | 2 1/4 | 17 | 142 | 190 | 332 | 15 | 86 | 107 | 254 | 10 1/2 | 301 | 303 | 428 |
| 60 | 20 | 15 | 5 | 17 | 143 | 192 | 342 | 15 | 83 | 107 | 285 | 10 1/2 | 307 | 311 | 419 |
| 50 | 25 | 17 1/4 | 7 1/4 | 17 | 140 | 208 | 345 | 15 | 80 | 89 | 291 | 10 1/2 | 391 | 400 | 538 |
| 40 | 30 | 20 | 10 | 17 | 133 | 197 | 362 | 15 | 90 | 82 | 296 | 10 1/2 | 350 | 355 | 475 |
| 30 | 25 | 30 | 15 | 17 | 123 | 191 | 329 | 15 | 78 | 77 | 266 | 10 1/2 | 362 | 359 | 478 |
| 20 | 20 | 40 | 20 | 17 | 128 | 199 | 318 | 15 | 66 | 73 | 285 | 10 1/2 | 317 | 374 | 480 |
| 10 | 15 | 50 | 25 | 17 | 122 | 201 | 324 | 15 | 68 | 72 | 221 | 10 1/2 | 291 | 354 | 488 |
| 50 | ... | ... | ... | 17 | 108 | 193 | 317 | 15 | 62 | 70 | 239 | 10 1/2 | 247 | 287 | 351 |
| 50 | 50 | ... | ... | 17 | 154 | 222 | 323 | 15 | 82 | 107 | 316 | 10 1/2 | 440 | 408 | 542 |
| 50 | ... | 50 | ... | 17 | 150 | 210 | 344 | 15 | 78 | 88 | 290 | 10 1/2 | 309 | 336 | 438 |
| 25 | 25 | 25 | 25 | 17 | 125 | 183 | 302 | 15 | 74 | 68 | 250 | 10 1/2 | 279 | 337 | 447 |
| 40 | Crushed quartz. | 60 | ... | 16 | 179 | 256 | { 3 mos. 355 | 14 | 93 | 100 | { 3 mos. 142 | 9 1/2 | 257 | 331 | { 3 mos. 351 |

All proportions and percentages determined by weight.

Natural sand, excluding residue on No. 8 screen.

No. 30 sand passed 20 screen, caught on 30.

No. 20 sand passed 8 screen, caught on 20.

No. 100 sand passed 30 screen, caught on 100.

"Fine" is clean white sand sifted through 100.

proportions given in the table. The test was made to determine the relative value of sand grains of different diameters, in combination with cement, and also to study the effect upon the tensile results of adding fine material.

Few unwashed natural sands are free from dust, of a loamy or clayey nature, and containing a high percentage of organic material, and in specifications usually calling for sand to be clean and sharp and free from fine material the importance of excluding this deleterious agent is recognized. It is, however, not always possible to enforce this absolutely, and from mechanical analysis of a large number of samples, and casual inspection of sand in use at various points, I am satisfied that much sand is used

This tendency, in the case of "Union," disappears at the 28-day period, at which time rather remarkable uniformity is found in all the combinations, except the 100 per cent. "Fine" shows serious retardation in the improvement of the "Hoffman," with the addition of fine material in the sand, between the 7-day and 28-day periods, the mixtures containing over 5 per cent. of "Fine" remaining almost latent for this time; three of the combinations show an actual loss, while four make a small gain, the average gain being two pounds; a rapid recovery is found, however, in these combinations between the 28-day and 6-month periods, and it is to be regretted that longer-time tests were not made.

A tabulation of the results, excluding the series in which all "Fine" and crushed quartz were used, is herewith given:

| | 7 days. | | | 28 days. | | | 6 months. | | |
|--------------|---------|------|------|----------|------|------|-----------|------|------|
| | Aver. | Max. | Min. | Aver. | Max. | Min. | Aver. | Max. | Min. |
| "Hoffman" . | 84 | 118 | 62 | 99 | 163 | 70 | 277 | 316 | 221 |
| "Union" | 139 | 156 | 108 | 198 | 222 | 183 | 336 | 362 | 302 |

The effect of the fine material upon the Portland cement is not so noticeable, even at the shortest period, except in the series with 100 per cent. and 50 per cent. "Fine," and no parallel can be drawn between the test with Portland cement and the results with Rosendale cement, using the same combinations of sand.

Cement users are coming to select their cement with more discrimination than ever before; their increased knowledge of the subject and the more extended use of the material show this to be necessary, and the natural result, owing to the struggle for commercial supremacy among the manufacturers, will be a better and more uniform product.

The chemistry of cement is an intricate problem and an academic knowledge of it without sufficient practical experience will result in much trouble to manufacturer and user alike. It is well said that "Experience is the best teacher."

SMOKE PREVENTION METHODS

J. W. ALLEN, Smoke Inspector to the Health Department of Minneapolis, has estimated the loss from damage by smoke in the city during the past year at \$5,500,000—five times greater than the annual loss by fire. That this official has no sinecure may be inferred from statistics as to the number of chimneys in the city. There are 83,000 of these, every one of which, at times, has a tendency to belch forth volumes of black smoke. These chimneys are divided into three classes—commercial, industrial and domestic. In the latter class there are about 55,000. Two-thirds of the remainder are commercial, of which about 90 per cent. burn hard coal.

In the industrial class there are about 10,000 chimneys subject to inspection. To inspect properly each chimney and the battery of boilers at its base takes on an average two hours. The Inspector works eight hours a day, and upon this basis it would take one man six years and nine months to complete the inspection of the 10,000 stacks in the city.

"With such a tremendous loss to commercial interests, and with that other loss in human vitality that cannot be estimated in dollars and cents, it should be plain to the people of Minneapolis that the Department should be made more efficient and enlarged," Mr. Allen recently stated to a representative of THE MUNICIPAL JOURNAL AND ENGINEER. "For the prevention of fires and conflagrations the city spends thousands of dollars annually and maintains a large force of men and the best equipment that money can buy," he continued, "yet the loss from fire is about one-fifth of that from smoke."

"The chief cause of smoking chimneys in Minneapolis is a lack of air in the boiler room. Architects seem not to take sufficiently into consideration that furnace rooms

should be equipped with air ducts through which an unlimited supply of air can be conducted to the furnaces. They put the furnace room in the basement far underground, and often hermetically seal it up with four brick walls.

"Another cause of smoke is the failure of the owners and operators of furnaces to take note of the adaptability of certain grades of fuel to the furnaces. They seem to think that any kind of combustible can be used. The grates of nearly all the furnaces in the city are too large. The greater number of pounds of coal burned per square foot of grate surface, the less smoke will be produced, because of the more perfect combustion.

"This smoke crusade is a matter of education, and the owners of plants, as soon as they can be made to see that it is to their own advantage, as well as to that of the city at large, to reduce the volume of smoke issuing from their chimneys become eager to make the necessary changes in plants and in their system of burning fuel.

"We are working along these lines. That is why we do not have, in Minneapolis, many prosecutions for the violation of the ordinance. I venture to say that within six months nearly all of the inveterate smokers among this city's chimneys will become models of cleanliness."

A different policy in the enforcement of the smoke ordinance of St. Paul has resulted in the suspension of the ordinance for one year, and the interval is being utilized by Dr. Justus Ohage, Health Commissioner, in investigating the health regulations of continental cities. Meanwhile, locomotives will be allowed to smoke continuously for not more than five minutes at a time, which, in Dr. Ohage's words, will give the citizens an opportunity of saying whether they like it better than no smoke.

A WEALTHY BUT PUBLIC SPIRITED CITIZEN of Cincinnati has applied for and undertaken the duties of Superintendent of the Street Cleaning Department at a salary of \$1,800 per year. Mr. Joseph S. Neave, who has thus identified himself with President Roosevelt's declaration as to the duty of citizens on retiring from personal business, was Vice-president of the Bullock Electric Manufacturing Company, and proposes to visit a number of cities to study the work he has taken up.

STREET RAILWAYS IN DARLINGTON, ENGLAND, appear to be an exception to the usually successful municipal operation of public utilities in that country. A net loss of \$7,000 is reported on last year's working, and even this does not include any provision for depreciation of plants, for which 6 per cent. per annum would not be an excessive rate. The adoption of low fares—one cent in some cases—for short distances, is blamed for the disappointing results.

DULUTH

Some Structural and Administrative Features of the Lake Superior City—
Object Lessons in Municipal Ownership

DULUTH, situated at the westerly extremity of Lake Superior, is built on a steep hillside, rising from a narrow strip of low ground along the lake shore to a height of from 400 to 500 feet. Its present population of about 80,000 has grown from 3,800 in 1880, and the advantages of its location, with its growing business facilities, indicate a continuance of rapid increase during the next few years. The importance which the city has already attained having led THE MUNICIPAL JOURNAL AND ENGINEER to seek for information in regard to its administration, the data for the following notes have been kindly furnished by the respective officials referred to. In addition, thanks are due to Mr. Herbert V. Eva, Secretary of the local Commercial Club, for replies to inquiries and active assistance in furtherance of the object in view.

Duluth's experience in the operation of its

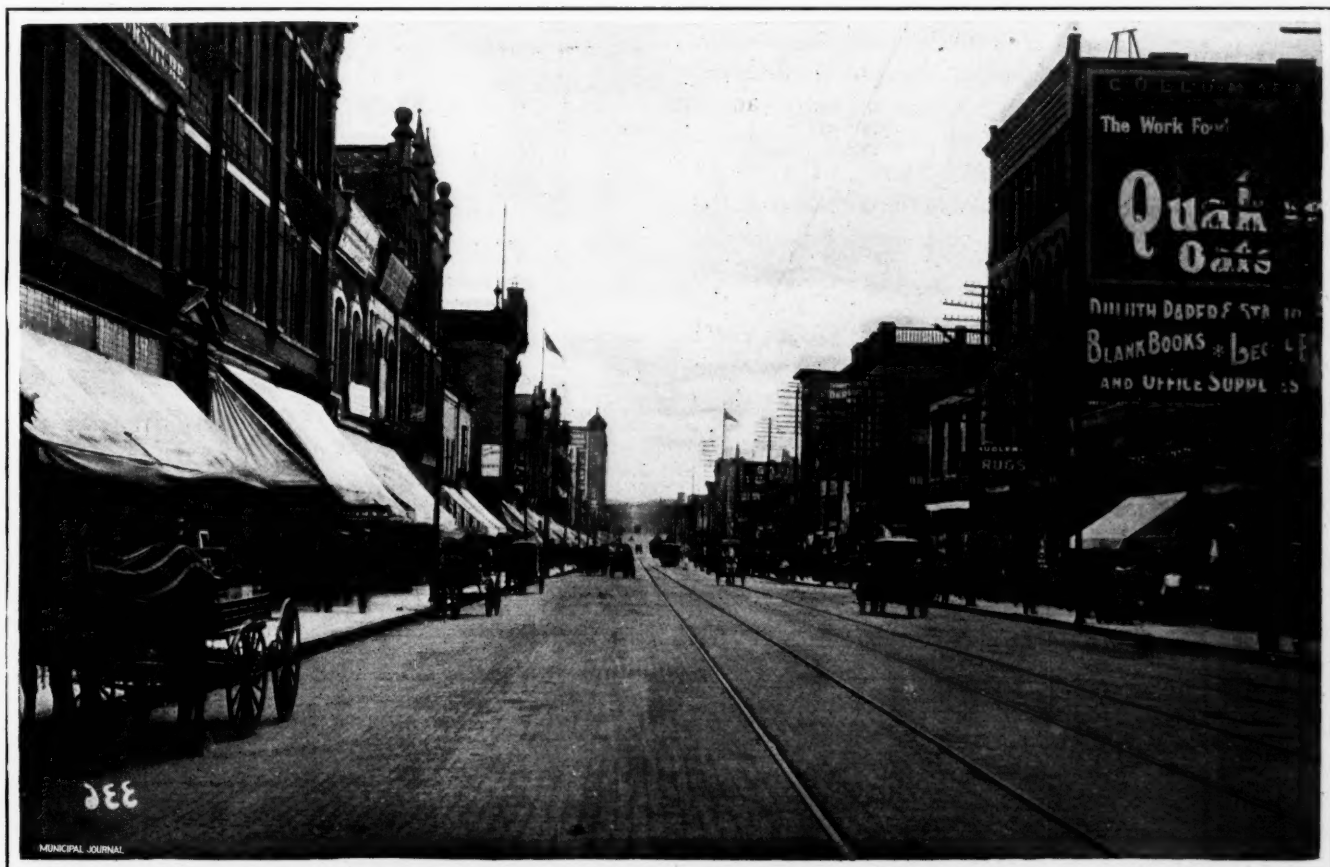
WATER AND GAS PLANTS

is referred to at length in a memorandum drawn up by Mr. L. N. Case, in which the conditions leading up to the transfer of those works from the former proprietary company are referred to. "In the year 1897," he writes, "an indignant people, burdened with excessive rates, oppressed with poor service and outraged with a polluted water supply, forced the issue by the partial installation

of a 'parallel' water plant, which resulted in the transfer from the company to the city, August 1, 1898, of both its water and gas plants."

At that time, the company's water rates were \$9 a year for each family occupying five rooms, with \$1 additional for each further room. An extra charge of \$5 was made for each bath, closet and basin. The charge by meter was at the rate of fifty cents per thousand gallons. The gas rates were, net, \$1.90 per thousand for light and \$1.00 for power. On the completion of the transfer, the city placed the operation of the plants in the hands of a Commission of five citizens, appointed by the Mayor for a term of five years, with practically full control, employment of the Manager and all other employees, and the fixing of their compensation, the purchase of materials and supplies and the adoption of the necessary regulations for the operation, maintenance, improvement and extension of the plants.

The "parallel" system already referred to, the construction of which was begun in 1897, is now known as the supplementary system and consists of a pumping station and grounds; about eight miles of 36-inch and 42-inch force mains, and a reservoir with a capacity of 13½ million gallons, the whole representing an expenditure of about one million dollars. The purchase of the



VITRIFIED BRICK PAVEMENT, SUPERIOR STREET, DULUTH

old plants cost, in round numbers, \$900,000 for water and \$350,000 for gas.

The funds required for the purchase and for the construction of the supplementary system were obtained by the issue of bonds, the annual interest upon which, together with that upon \$140,000 applied to the purchase of the West Duluth plant and \$110,000 used in making extensions and improvements, amounted in 1904 to over \$120,000. Of this amount, \$55,000, or nearly one-half, arises from the borrowing of money to build the supplementary system, and as this was constructed solely for the purpose of obtaining a pure and more wholesome supply it contributes nothing towards meeting its interest payments.



THE 13½-MILLION GALLON RESERVOIR.

Handicapped as the Department was, and in spite of predictions of financial disaster, successive annual reports pointed to a very different result. The opponents of municipal ownership in general and of this example in particular then started the cry that the Manager was juggling the figures, and this was followed by assertions to the effect that expenses were being charged to construction which should be charged to operation and maintenance. These having been effectually disposed of, an attack was made upon the reductions in rates, on the ground that the Department would be unable to pay taxes on the plants—an imaginary obligation, as no taxes are imposed on city property.

These reductions may be stated here. For water, the present rates are:—Family in five rooms, \$6.00; extra rooms, 50 cents each; baths, closets and basins, each \$2.00; water by meter, 17½ cents; easily one-half those under the company's administration. The gas rates are now:—Light and cooking, 75 cents; heating, 40 cents; again one-half the former rates.

The sale of gas, which amounted to 20 million feet in 1898, has increased to 110 million feet this year.

Up to January 1, 1905, the savings effected by the purchase and operation of the water and gas plants can be summed up as follows:—

| | |
|--|---------------------|
| Accumulations.. | \$112,246.00 |
| Reduction of rates..... | 400,000.00 |
| Interest on cost of construction of supplementary system, for pure water and health. | 331,500.00 |
| Reduction in prices on service extensions, water meters, etc..... | 25,000.00 |
| | \$868,746.00 |

As against these items, the city has lost the taxes which would have been imposed upon a private company, aggregating \$105,000. It has also been obliged, under a mandatory clause of the charter, to apply \$50,652 to the general reduction of water rates. These sums, deducted from the gross credit amount, leave a clear gain of \$713,112 as the result of municipal ownership and operation under conditions far from favorable to financial success.

THE ENGINEERING DEPARTMENT

of the city, in charge of City Engineer Thomas McGilvray, M. Am. Soc. C. E., has charge of all new work for the whole of the city departments, but the maintenance is under the supervision of the Board of Public Works.

The pavements of the city consist of every kind of pavement ordinarily used, from gravel to asphalt. Superior street, the principal thoroughfare of the city, was paved, some four years ago, with brick grouted on a sand cushion, laid on a 6-inch Portland cement foundation. The results, as regards cost, cleanliness and wear, have been excellent, but there are objectors on the grounds of slipperiness and noise. On Michigan street—the wholesale, heavy traffic street—the pavement is of Kettle River sandstone blocks, laid five years ago. Many of the steep-grade streets are paved with this material, which has proved itself to be a very excellent pavement as regards durability, noise, cleanliness and non-slipperiness. It is, however, somewhat expensive, costing, for blocks alone, about \$1.60 per square yard, f. o. b. Duluth. These blocks are laid on a 1-inch sand cushion, placed on a 5-inch concrete foundation, and are filled with Portland cement grout, as in the case of brick paving.

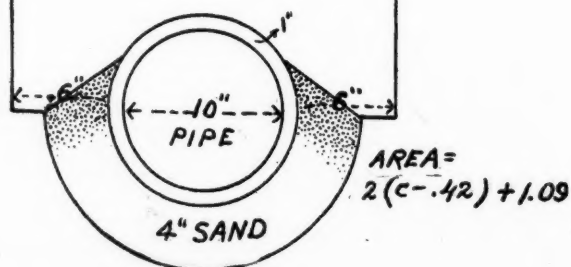
The city has laid about 60,000 square yards of tar-macadam pavement, some of which has been in use over

NOTES.

NO TRENCH TO BE LESS THAN TWO FEET IN WIDTH.

FOR ALL SIZES OF PIPES. LARGER THAN TEN INCHES IN DIAMETER, THE EARTH WILL BE TAKEN FOR SIX INCHES ON EACH SIDE OF THE PIPE AND THE SIDES WILL BE CALCULATED AS VERTICAL.

EARTH TRENCH.



DATA FOR 10-INCH PIPE SEWER IN EARTH TRENCH

four years. The first streets were paved by Warren Brothers under their Bitulithic process, but about two years ago the city bought a tar-macadam mixing machine, at a cost of \$9,000, which is used by contractors in making their tar-macadam. A charge of \$20 a day is made for this use. The result of owning this plant has been a great saving in the cost of this work. While the prices per square yard formerly ranged from \$1.60 to \$1.80, the cost is now reduced to \$1.14. The local trap rock, when prepared for the tar mixture, is of excellent quality, and contributes largely to the success attained in tar-macadam paving.

In addition to the pavements cited above, there are creosote block paving, asphalt, and cedar block, common macadam and gravel. All of which, except perhaps the cedar blocks, give good satisfaction.

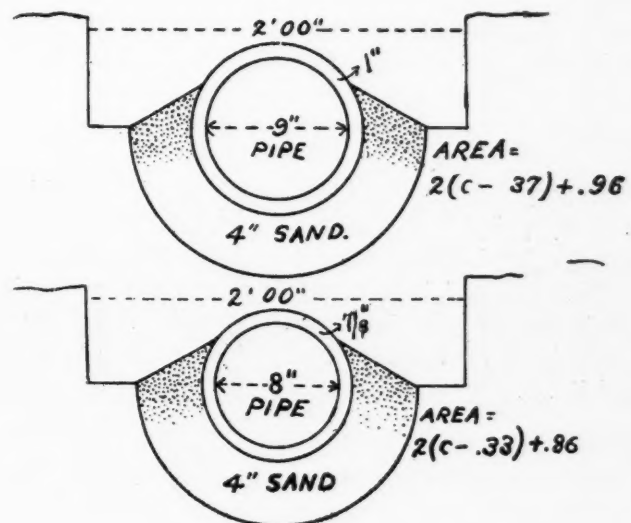
The sewerage system is in the peculiar position of having the usual problem of small grades reversed, *i. e.*, the slopes in the city being very great, the sewers are rapidly wearing out on the bottom. For the same reason, an immense amount of water has to be taken care of during storms, almost the entire rainfall reaching the sewers as it falls. In designing storm conduits, the Department deduces their size from the assumption of a volume of flow equal to two cubic feet per second per acre, due regard being paid to the slope of the tributary area. All sewers of over eighteen inches in diameter are constructed of concrete, as it is found to be as durable and much cheaper than large sized vitrified pipe.

STREET CLEANING

is done by the city, under the supervision of the Board of Public Works. On sandstone and cedar block pavements, machine sweepers are used two or three times a week, as may be necessary, the sweeping being preceded by light sprinkling.

Asphalt, brick and tar-macadam pavements are flushed once a week from hose attached to hydrants, the use of the large sweeper, particularly on Superior street, being dispensed with. On pavements which are flushed, men equipped with hand brooms and patrol carts are constantly employed removing litter as it appears. This is, practically, the "block" system, and is demanded for all streets upon which high-class and expensive pavement is laid.

The amount expended for street cleaning in 1904 was \$15,578.57. The work constitutes one of the largest items



DATA FOR 8-IN. AND 9-IN. PIPE SEWERS.

of expenditure in the Public Works Department, and the cost is likely to increase proportionately with the extension of highly finished pavements throughout the city.

AN INDEPENDENT ASPHALT ASSOCIATION

WITH the object of "discussing the various questions of interest to the industry, arising from time to time, and to exchange views as to the best method of extending and developing the business and improving the quality of asphalt pavements," twenty-seven asphalt paving companies and firms have effected an organization under the above title. Representatives of these companies and firms met in New York on January 17th, many of them dilating upon the demoralized conditions now prevailing in the asphalt business. While asphalt pavement was described as being more popular than at any previous time, it was alleged that the low prices now ruling induced—almost compelled—contractors to slight the work and to evade specifications. These conditions were believed to have fostered the use of worthless and adulterated grades of bitumen. Taxpayers suffered in the end, if only through the ruinous expense imposed upon them for the repair of asphalt pavements after the expiration of the maintenance period.

Mr. Amzi L. Barber, of New York, was appointed

President of the Association, with W. H. Kinch, Buffalo, N. Y., and David McCormick, Chicago, Ill., as First and Second Vice-presidents respectively. The Secretary, P. W. Henry, has offices at 17 Battery Place, New York. Other contractors, from whom letters were received at the meeting, are expected to join the Association, for which "all reputable firms and companies engaged in the production of asphalts and in the laying of pavements" are eligible.

The formation of the new body has led to recriminations between Vice-president Arthur W. Sewall, of the Barber Asphalt Paving Company, and Mr. Amzi L. Barber, named above. The latter denies that anything in the nature of a "trust" is intended, the object being simply to improve the quality of the work, necessarily involving higher prices. Mr. Sewall's Company, he states, was the only one, out of thirty-five invited, declining to join the new Association. Incidentally, the Bermudez Lake concession, and the relations of Mr. A. L. Barber with President Castro are brought into the controversy.

MUNICIPAL OWNERSHIP—LET THE PEOPLE DECIDE *

Mayor Tom L. Johnson, of Cleveland, Reviews the Arguments Involved in a Decision

ALL that I have ever advocated in the way of State legislation along the line of municipal ownership has been simply a grant by the Legislature to the people of cities, villages and counties to own and operate public utilities if they may elect by majority vote so to do.

I believe that the people of a community should not enter lightly into a municipal enterprise. They should carefully study the arguments for and against, and, above all, each new proposition should be studied alone.

No people should say that they will own all or will not own any public utility. There may be as good reasons for engaging in one as for not engaging in another.

There exists, I believe, a safe rule to apply as a first test to an enterprise in order to determine whether it is a fit subject for municipal ownership. It may be stated as follows:

A PUBLIC GRANT

No enterprise should be considered a subject for municipal ownership unless it (1) rests upon a public grant or franchise bestowing a special privilege; (2) is of such a nature that competition cannot enter with benefit to the people at large; (3) requires a very large expenditure of capital for a plant and equipment, and (4) contemplates a performance of its functions for a long period of time.

Now, let us analyze this rule with regard to its four subdivisions, and we find that it takes us pretty well over the field of municipal ownership and municipal politics and citizenship as well.

First, then, why should an enterprise that rests upon a public grant or franchise bestowing a special privilege not be conducted by a private corporation?

Because it makes necessary the lodging of the power to grant franchises and special privilege in some council, legislature or other public body or official. Just as soon as this is done it arrays against the city a class of men who otherwise would be the very best men in the community. Just as soon as a man becomes the owner of stock in a public service corporation he has an interest absolutely opposed to the interest of the city. The more "liberal" the franchise the worse is the bargain for the city and the public.

THE PEOPLE BENEFIT

For this reason the class who should be our best citizens are best served by the worst city government. The merchant, manufacturer, real estate dealer and mechanic are all benefited by whatever will tend to reduce the cost of car-fare, gas, water, garbage collection and taxes, while the owner of stock in a street railroad, gas or water

company is directly interested to have the cost of these services as high as may be.

We are familiar with the high-minded action and attitude of Chambers of Commerce and similar semi-public bodies. This is because they have in view the common good and are not distracted by private interests. Give the Chamber of Commerce the power to grant privileges and franchises whose value runs into millions and it would soon be the scene of "dirty" politics and would be filled with boodlers, who in turn would be backed and put forward by franchise seekers.

Whenever a franchise is to be given away, franchise seekers will be found wanting it, and between the franchise seeker and his prize is the middleman, who is put forward in order that the respectable franchise seeker may not have to soil his hands and lose his reputation.

But it is the buyer of privilege rather than the seller who corrupts our city politics. It is not politics that soils and pollutes business, but business that prostitutes politics.

The second requisite for a municipality-owned enterprise is that it is "of such a nature that competition cannot enter with benefit to the public"; in other words, the function must be a monopoly.

It must be something that a large majority of city dwellers must use, an enterprise that the natural tendency to consolidate, in private hands, is greater than the tendency to compete. There would be a distinct loss in operating expense, efficiency and good service if there were two Postoffice systems, two water works or two garbage plants.

WHY CORPORATIONS MERGE

This is why, in every city, the tendency for street railways is to consolidate with each other, and then to consolidate with power and light companies. Whenever the people require an indispensable service to be rendered them they cannot, wisely, put the performance of that service in private hands unless it is possible, by future grants, to create, or threaten to create, a competing interest in what will compel proper service at fair cost.

The third and fourth requisites—namely, a service "involving large outlay for plant and equipment and contemplating continued service"—are coupled. No private interest can afford great outlay unless it is assured a franchise long enough to pay back its initial expenditures and a fair return on the investment. This means that the public must not only pay for service rendered, but must also pay outright for the plant itself. The shorter the franchise, the poorer the service must be in private hands, and the longer the franchise the less the public can safeguard itself as time goes on.

* Specially contributed to the Cincinnati Post.

PEOPLE'S FRANCHISE

No franchise can be granted on terms that are fair at the time of the grant without in the end, by reason of the growth of population and progress of invention, working a hardship to the public which grants the franchise.

The public itself, on the contrary, has a perpetual franchise, and with the growth of population and the installation of improved methods the cost of service must be constantly reduced, in which case the public reaps all the benefit.

The people of the city of Cleveland, for instance, are paying dividends of 15 per cent. on the actual money invested by private interests in its street railways; indeed, the Street Railway Company is actually earning, net, 20 per cent. of its money investment and paying 15 per cent. dividends. This is concealed by the fact that securities have been issued in such volume that the apparent dividend return is only 15 per cent., but it is admitted that the physical property of the Company could be reproduced for one-third of the money represented by the securities issued.

MEANS BETTERMENT

The worst feature of private ownership of public utilities, after all, is the creation of a hostile interest which is directly at variance with the best public administration of the city's affairs. The water works system of Cleveland would, in private hands, be easily worth \$20,000,000, yet the plant has largely been paid for out of earnings, and rates are constantly reduced and service bettered.

Using Cleveland as an example again, we find that, under a singularly honest policy, the street railway is far more active in politics, both as a corporation and as represented by its stockholders, than the Water Works Department—owned by the city—has ever been, even under the most vicious city administration.

ment—owned by the city—has ever been, even under the most vicious city administration.

Think what a *furor* would be raised if the city of Cleveland suggested selling its water works plant to a private corporation.

It is not difficult to compare the cost of any public service under public and private ownership. Under private ownership the charge to be collected from the public must be large enough to (1) pay operating expenses, (2) provide against depreciation and betterments, (3) earn a fair dividend on actual capital invested, (4) pay dividends on any securities issued in excess of the actual capital invested and (5) repay during the life of the grant not only the actual investment, but the "water" as well.

REDUCES THE COST

Under municipal ownership the cost of service would only have to include the first two items, with the addition of a sinking fund charge to retire the bonds representing the original cost of the plant, or from one-tenth to one-third of the fifth item.

All the money now devoted to the third and fourth items and the greater part of the fifth item would either be saved directly in reduction of cost to the public or in bettering the service.

Safeguard these activities by strict civil service, and the most extravagant administration could not overcome the handicap imposed on private ownership by the rules of modern finance.

Municipal ownership applied to such functions as came under the rule first stated must then inevitably result in the following three benefits: (1) Purify politics by extinguishing a powerful interest hostile to good government, (2) work betterments in service and (3) reduce the cost of service to the public.

CONTROL OVER SHADE TREES

THE question of the extent to which a municipality has control over shade trees is involved in a suit which will be brought by the executors of an estate (one of whom is Supreme Court Justice Mahlon Pitney) against Alderman Jenkins, Chairman of the Street Committee of the Dover, N. J., Common Council, and Wm. H. Mase, who was Street Commissioner up to January 1. The employees of the Street Department having cut down, in December, two trees in front of a property owned by the estate in question, a demand for \$200 damages was served upon Alderman Jenkins and former Commissioner Mase by former Town Attorney Ford D. Smith, now acting as the estate's attorney.

Alderman Jenkins paid no attention to the demand beyond reporting the matter to the Council, and that body took no action, although, in the discussion which ensued, the consensus of opinion expressed was that the governing body of the town should defend the action of its officers.

The claimants base their demand upon the fact that

there was no specific act of the Common Council authorizing the Street Committee or the Street Commissioner to cut down the trees. The Street Commissioner defended himself by the statement that the trees had been badly eaten by horses and that the upper branches had been burned and killed by electric light wires.

Town Attorney Ellicott told the Council that if the Street Commissioner thought the trees were a menace to traffic he was entirely within his rights in removing them without any direct orders to do so, for the ordinance relating to the duties of that office says, "that the Street Commissioner shall have power, and that it shall be his duty *upon his own view thereof*, or when notified to do so by the Mayor, Common Council or Street Committee, to remove from any of the streets, alleys, sidewalks or public grounds of the Town of Dover any and all unlawful obstructions, incumbrances and nuisances that may be therein or thereupon." It is obligatory upon the executors, in the opinion of the Town Attorney, to prove that the Street Commissioner exceeded his authority.

THE CONSTRUCTING ENGINEER*

His Position and Duties in Relation to Inspection and the Enforcement of Contracts

By Albert J. Himes, M. Am. Soc. C. E.

THE Author's introductory statement that "in a broad sense, every man who has charge of engineering work is an inspector," is followed by some observations as to the true nature of a contract and the conditions which must be fulfilled if it is to be effective as a legal instrument. The paper proceeds as follows:

The failure to understand, in the beginning, the subject of a contract, is a fruitful source of dissatisfaction. In engineering work there is too much laxity in the preparation of specifications. The specifications of the engineer are always made a part of the contract, and many times they are quite obscure and indefinite. In this is seen a need for greater facility of expression among engineers. They should spend more time, during education, in learning how to use the English language. The technical education is not enough. An engineer should talk and write fluently.

There is also among engineers a lack of appreciation of the necessity of definiteness in their specifications. It often happens that the engineer who, by reason of experience and ability, is qualified to write the specifications, is so burdened with administrative details that he has no time to spare, and the work is turned over to an office assistant who has no qualification for the work.

This laxity has been a frequent source of trouble on public work where the engineers, coming from work not surrounded by governmental restrictions, have learned by hard experience that both contractors and taxpayers have a right to a strict and impartial interpretation of their contracts, and that, unless clear and specific, such an interpretation is very difficult. . . .

The first difficulty to be encountered is usually some error or omission in the plans or specifications. This defect must be corrected. The contract, in so far as this item is concerned, is void, for, clearly, there has not been a "meeting of minds" concerning it. If the matter is of minor importance, the contract usually provides that the engineer shall decide what is to be done; but he cannot decide that the matter is one of minor importance. His direction concerning it assumes such to be the case, and, in following that direction, the contractor accepts the engineer's assumption, but the degree of importance of the matter is a question of fact that may be submitted to a jury on the application of either party to the contract.

Next, there may be found something that is impossible

of construction or needlessly expensive, and the contractor may object to it or propose some other method. Again, the same rule applies. The engineer may decide, and the contractor may accept the decision, but either party to the contract may invoke the law, to determine whether the degree of importance of the matter will suffice to annul the contract and render a new agreement necessary. For this reason many contracts provide for supplementary agreements to cover such matters, but, whether or not such agreements have been provided for, they may be made at the option of the parties interested. . . .

For such reasons as these, it has become common to insert in the contract a clause providing for increase or decrease of work, changes of plan, and delays. Such a clause may or may not be binding, according to how it is used. A contingency is a proper subject for contract, but that contingency must be clearly expressed. No blanket clause will cover contingencies not considered when making the contract.

A blanket clause is often construed liberally in the interest of the party of the first part, and the interpretation is a source of great dissatisfaction on the part of the contractor. That he does not more often seek redress in the courts is because of the expense and delay attendant thereon. The sum involved must be large, to warrant such a procedure. The theory of the law is held by its devotees to be the discouragement of litigation, and, in this respect, because of the expense and the numerous difficulties and delays in getting a final decision, the legal profession has attained a degree of perfection which engineers may not hope to equal. . . .

Being familiar with all conditions surrounding the contract, the inspector goes on the work intending to secure the best results possible, both by lending his aid in every way, and by insisting on the correct performance of the work. He is soon confronted with the problem of deciding whether certain work is good enough to accept or bad enough to reject. It has been said that work or material is either good or bad, that there is no middle ground, that the competent inspector must be able to distinguish clearly the difference, and require only that which is just, never accepting anything at fault and never rejecting that which is good. That is a sound position, if taken generally, not rigidly. Rigidly, it is the dictum of conceit and arrogance; conceit, because it assumes perfection on the part of the inspector, and arrogance,

* A paper (condensed) discussed by the American Society of Civil Engineers, January 3, 1906.

because, born of ignorance, it permits no question to be raised. Absolutism has no place in business. Business men are accustomed to dealing with practical affairs, and have little use for perfection. It is for this reason that a skilled and conscientious engineer may at times hear his efforts referred to contemptuously as "hair-splitting niceties," and find himself classed among men who have no judgment.

All things are relative, and are governed by conditions. First-class ashlar masonry is seldom used for retaining walls, and machine-shop methods are not expected in structural work. If the specifications seem to mean otherwise, they must be very clear and definite, in order to stand. Where the specifications are obscure, or where they conflict, custom will govern; so, if a man has some unusual and particular matter which he wishes observed, in the execution of his plans, he must make it very plain in the contract. . . .

Most specifications call for first-class work. First-class work is simply the best of current practice, and, therefore, it behooves the engineer or inspector to be as thoroughly posted in current practice as in his own specifications.

Again, the personal equation of the inspector must be recognized. It is an old trick for a contractor to confront a young inspector with, say, a cross-tie which he has rejected and one which he has accepted, and ask him which is which. Every experienced inspector knows that he will at times accept, and at times reject, things which are, so to speak, on the dividing line. He must have an ideal, a standard, and if, through good nature, he accepts things which are not quite up to the standard, he does not escape the difficulty; he simply lowers the standard. If the work could be graded by percentages, and the rule was to accept all that ranked 90 per cent., he would find himself accepting 89 per cent. and rejecting 91 per cent. That is the imperfection of human nature, and it cannot be helped. It would not make matters better to drop the standard to 89 per cent. The same conditions would exist. Between narrow limits, the inspector should have full authority to decide what he will take and what he will reject. It is seldom that a contractor objects to the classification of an experienced inspector.

There is a great variety of inspection, and it is performed in many different ways. In any specific case its purpose should be clearly in mind, and the means used should be adapted thereto. It may be desired to examine minutely for the detection of flaws each individual item, as in the case of steel eye-bars for bridges. Or it may be desired merely to exercise a restraining influence by occasional and partial inspection. The latter aim is the more common, and generally results in superficial work of very little value. . . .

The tests to be applied to cement are a matter of prime importance, and have been the subject of much research and experiment. If a contractor persists in using cement which has been condemned, and is not restrained from completing the work, but is denied payment, he may take the matter into the courts and endeavor to collect com-

pensation. In that event it would not be enough for the engineer to show that the cement was not in accordance with the specifications. Granting that was established, in order to claim damages he would be obliged to demonstrate the bad quality of the cement and its resultant injury to the work. That is the supreme test of the specifications, and one which they frequently will not stand. When a man specifies something as a matter of judgment, the necessity for which cannot be readily demonstrated, and the contractor tries to use something else, the best way is to stop him at once. In doing so, the engineer may bring upon himself the charge of delaying the work, but he must be prepared to meet it.

Controversies of this sort have much to do with the objections to letting work publicly to the lowest bidder. When a man has shown a lack of disposition to carry out work as planned, without a dispute, engineers do not care to have him secure their work. In government work, as in private affairs, if the lowest bidder is irresponsible, his bid may be rejected, but it may be necessary to show his lack of responsibility. To do this without raising a suspicion of fraud requires evidence acceptable to the court, and it may be hard to secure. In private work an opinion is often sufficient. . . .

Some men have discovered that uniform excellence of material and workmanship is the road to both cheapness of production and a generous demand for their products. They do their own inspecting very thoroughly, and are well pleased with the results. It is a pity that there are not more men of the same mind.

There is this to be said, however, in favor of the contractor doing general work. He meets many engineers with many different ideas of construction, and if he is himself an engineer by training, he finds at times that the things he would do as an engineer do not please the engineer in charge of his work, and the things which the engineer does require are things which he as an engineer would condemn. After a few experiences of that sort, it is not to be expected that a contractor will do more than enough to secure his compensation.

When the contractor exhibits an unwillingness to perform good work, or to replace defective material, the task of an inspector becomes very difficult and at times unpleasant. To prescribe a set of rules for bringing a contractor to terms would be as absurd as it is difficult. When the conditions of strife degenerate to a state of war, only a soldier can understand the multitude and variety of tricks and devices which are used to defeat the aims of proper inspection; and, to meet these attacks, to checkmate the moves and emerge from the contest with a clean record and a good reputation, requires the resourcefulness of a modern diplomat. In all such cases, the inspector is not only obliged to keep his temper, but he must be just. Recrimination is fatal. It places him on a level with his opponent, and subjects him to the same examination and suspicion. He must maintain a judicial attitude, and permit no irritation or fear to influence in any way the discharge of his duty.

When some engineers find that a contractor is disposed

to slight his work, they permit him to operate for a time unwatched, and then, appearing suddenly on the scene, catch him red-handed and require him to tear down and rebuild the unsatisfactory work. It is natural to feel resentful and to wish to retaliate for a breach of good faith and confidence, but the law does not uphold such methods. It is the duty of an inspector to be on hand while the subject of his inspection is under performance, and, if he absents himself, he is at least morally guilty of contributory negligence, and should be estopped from exercising the same rigidity of inspection that he might use were he himself not at fault. In other words, being partly responsible for the poor work, he is not in a position to pass judgment and inflict punishment.

The time to protest or condemn is always the time of the act in question, and, in law, a man who remains silent when he should have spoken is regarded as a partner in the guilty act.

A man who protests habitually against everything that is done becomes known as a "kicker," but, however disagreeable that appellation may be, it is better to call at-

tention to any defects at once, speaking to the contractor first, and if the matter is ignored, it should be referred to higher authority or taken under consideration by one who has power to act.

But when a protest concerning work or material is ignored, the inspector should not sit idly by and see all evidence of the defects obliterated, so that when the time of settlement arrives there is nothing to support his statement. Should the law be invoked to settle the matter, his word would not go far without confirmation, and he should preserve for future use such notes, references, or photographs as would enable him to prove, absolutely, the correctness of his assertion. The contractor, of course, would seek to rid himself of such an "officious inspector," but these things verge upon war, and a man must be the judge of his own acts. If he is a man of good morals and the right preliminary training, his wits will help him through many a scrape, and it is one of the pleasures of an inspector's life to receive expressions of gratitude for kindnesses done to a contractor who has all but accused him of crime.

(To be continued.)

GERMAN WORKMEN'S HOMES

THE MUNICIPAL JOURNAL AND ENGINEER of December, 1905, contained, on page 273, an illustrated article on "Workmen's Homes in England and Germany," in which especially valuable reports by U. S. Consul Harris, of Chemnitz, were referred to. The criticism has been made, in regard to these reports, that the only class of homes deserving attention in the United States, so far as the working class housing problem is concerned, are those yielding a reasonable interest on the investment, over and above the fixed charges. It will be remembered that this condition is not attained by some of the examples—otherwise of commanding excellence—dealt with in our December article, and the defect has been brought under Consul Harris's notice. Replying to correspondents, he writes:—"This may or may not be true. The experience in Austria, however, where the average manufacturer furnishes dwellings and fuel to his workmen free of charge, has been to minimize the number of strikes. I am satisfied that this has also been the experience at Port Sunlight and Bournville villages, in England, where the rents are practically fixed at rates which pay only for maintenance, taxes, and repairs, as well as at Essen, where the Krupp enterprises yield about 2 per cent. on the investment. It stands to reason that if a manufacturer could eliminate the danger of strikes from his yearly programme he would soon make good any extra expense he was put to in order to place good dwellings at the disposal of his workmen, either for a nominal rate of interest on the money invested, or even free of charge. This Utopian state of affairs, however, will not come to pass, and, as long as human nature is so constituted as it is, labor troubles will always exist in some form or other. Experience has shown, however, in Germany,

as perhaps elsewhere, that the more a manufacturer learns to differentiate between a man and a machine, the more is he likely to reduce the danger of strikes.

"In a country like our own, where so much money is being given by philanthropists to charity, education, and other enterprises, it would seem that the great schemes of housing working people might be a subject worthy of consideration. Experience has shown thus far that the average attempts to lessen the danger of labor troubles have been but superficial methods applied for the purpose of securing momentary alleviation after strikes have commenced, rather than seeking for something which will tend to remove the cause. The chances are, however, that good treatment and a well directed philanthropy toward securing suitable homes for working people will in the long run form the most potent antidotes against the desire to strike. Strikes, generally speaking, are no longer local in their influence. They cast their shadows all over the world, and each teaching its own lesson.

"I had an opportunity recently to discuss the question of workmen's homes and strikes with a gentleman who owns a large mill which gives employment to several hundred men. He is a member of the organized syndicate of manufacturers for the prevention of strikes, and his business is suffering very much at present on account of the strike in the textile districts of Saxony and Thuringia. He said that if he had a million marks (\$238,000) which he could devote to that purpose, he would introduce the Krupp housing scheme into the textile districts of Saxony, where thus far nothing of the kind is being done. This gentleman evidently considers that such a step would achieve good results, and a subject well worth the consideration of manufacturers in Saxony."

THE SUPPLY OF MILK TO CITIES

A Sanitary Problem of Growing Interest to Large Populations—A Field for Municipal Effort

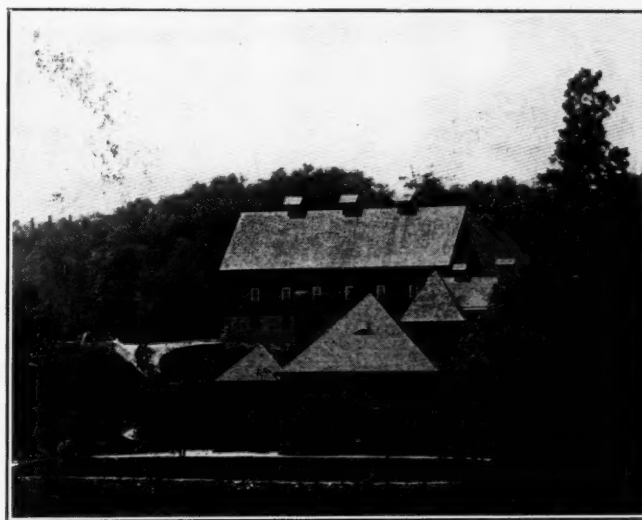
THERE are many evidences of the changes operating in regard to the ideas once generally entertained on the subject of milk. From being looked upon as an eminently safe product, immune from the contaminations believed to affect other articles of diet, it has come to be included among the items of daily consumption needing constant watchfulness, not to say suspicion, if the risk of disease through this medium is to be avoided. It has long been known that milk had much to do with those high rates of summer mortality among very young children which, in an earlier age, were accepted as due to the intervention of a mysterious "Providence" in mundane affairs. In no field, perhaps, have the researches of bacteriologists been more fruitful of result, in a practical direction, than in the enforcement of hygienic lessons in regard to the sterilizing of milk intended for infantile consumption, and it is safe to say that thousands of lives have been saved by this particular application of the germ theory.

These remarks are prompted by the study of a report, recently issued by the U. S. Department of Agriculture, dealing with the milk supply of Boston, New York and Philadelphia. Written by Dr. George M. Whitaker, Dairy Inspector, Bureau of Animal Industry, it gives a detailed account of the methods employed to connect the large populations concerned with the often distant sources of supply. These methods vary widely in such particulars as the size and character of the cans used for transportation, the relations subsisting between the producers and the distributors, and the degree of attention paid by one or the other, or both, to such matters as the cleansing of cans. Lest the casual reader should be disposed to regard so small a matter as possessing no claim to consideration, let it be said that the class of stopper used for the cans has given much cause for study, the absorbent qualities of the wooden article generally used around Boston rendering it peculiarly objectionable from a bacteriological standpoint.



BRIARCLIFF DAIRY: THE OFFICE

The washing of cans has long been a bone of contention between the farmers and the contractors, the latter urging, with some truth, that to wash the cans in the city might lead to laxity in this respect at the farms. On the other hand, the facilities for washing, and especially for sterilizing by steaming, are naturally less complete than



BRIARCLIFF DAIRY: THE OFFICE AND BARN

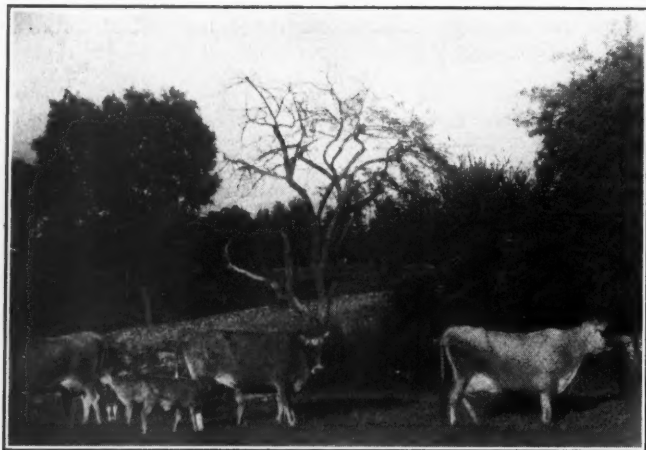
at the central stations of the contractors, where the milk is mixed and filtered on its arrival. The necessity for the latter process is pressing enough if one may judge from a passage in the report, giving details of the arrangement of wire screens and cheese cloth through which the milk is passed. "When this strainer has been in use for some time," the report states, "another is substituted, the cotton being stained quite dark with the manure and other filth which have been taken from the milk." Of the conditions affecting the New York supply, it is recorded that, in one section, "out of a total of 2,458 [grocery] stores visited, only 454 were found where the milk was properly cooled and where there was no communication with living rooms."

Philadelphia has a Pediatric Society—an association of physicians especially interested in the treatment of diseases of children. The milk question has engaged the attention of the society, a special committee being entrusted with the inspection of dairies and their inmates, human and bovine. Milk delivered under this inspection is sent out with labels stating the guaranteed percentage of butter fat. Tests are regularly made for bacteria, the fundamental idea of the society being that natural, untreated milk, *i. e.*, not sterilized, from healthy cows, and produced under sanitary conditions, is the best for infants.

Without going quite as far in that direction, New York

City has sources of milk supply equipped with such facilities for sanitary production and distribution as to remove all thought of danger in this connection. Among these, the Briarcliff Dairy, of Briarcliff, N. Y., recently selected for inspection by a representative of THE MUNICIPAL JOURNAL AND ENGINEER, stands as a typical example of what can be done in dissociating milk production from unsanitary conditions.

Instead of dilapidated buildings, with disjointed and leaky floors, the barns are large, light structures, with interiors as free from timber as can be attained and with impervious concrete floors scrubbed every day. Six such barns, scattered over a distance of four miles, shelter a



BRIARCLIFF DAIRY: A FAMILY PARTY

herd of Jersey stock aggregating nearly thirteen hundred in number, and a wide expanse of grazing land affords the necessary summer pasturage.

Before milking, the cows are groomed, a process including the careful washing of their udders. They are then chained, on a bed of fresh straw, so as to prevent their lying down until after the milkers, clothed in white overalls, have drawn their burden into sterilized pails. The milk is taken to a receiving room on the second floor and passes thence to the bottling room below, where machinery takes the place of handling at this important

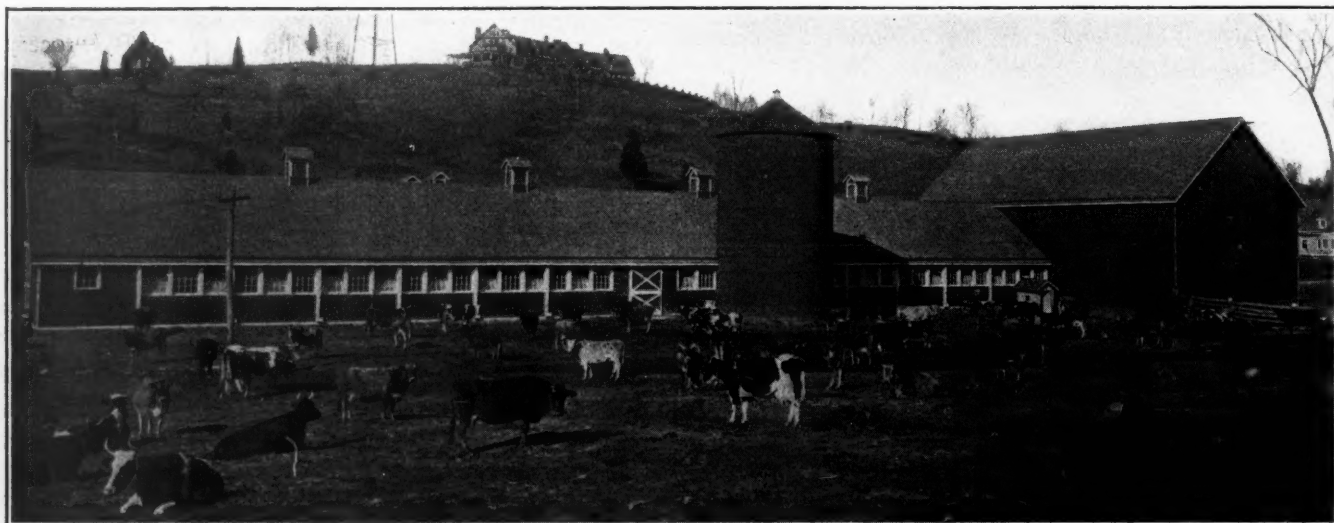
stage. The pasteboard discs, closing the mouths of the bottles, are supplemented by vegetable parchment covers, tied on, the date of bottling and the certification of inspection being given on the latter. Ice is used in the boxes and on the cars for transit to the city.

The machine cleansing of the returned bottles is effected by swiftly rotating stiff wire brushes reaching every recess. After several washings, they are sterilized, by heat, for two hours and stored for subsequent use.

The testing of the milk includes the determination of the amount of butter fat present, all milk sold to the public having to contain, under ordinance, a minimum of 3.4 per cent., an amount largely exceeded in the case of this dairy. A chemical analysis of the milk is made once a month, and bacteriological tests are made weekly. The tests for tuberculosis, particularly important in view of the alleged communicability of this disease to human beings, involve observations as to the effect of a hypodermic injection of an infected medium. In addition, special care is taken of the health of all employees.

The question arises whether the precautions outlined above can be applied to the general consumption of milk in cities, and suggests the necessity of more comprehensive action, by municipal bodies and their sanitary staffs, than is comprised in the measures usually adopted. How far it may be necessary for cities to assume direct control of such a matter is a problem not to be lightly decided, but it may be noted that this step is warmly advocated by many foreign hygienists, and Battersea, the metropolitan constituency which sends John Burns to Parliament as President of the Local Government Board, has a municipal sterilizing station at which milk for infants is dispensed. The proposal has recently been made by Prof. John M. Trueman, head of the Dairy Department of the University of Illinois, that the milk supply of that city should be municipalized, as tending towards purer and cheaper milk.

Our thanks are due to Mr. H. H. Law, of the Briarcliff Dairy, for courtesies rendered our representative and for the photographs from which the accompanying illustrations have been produced.



BRIARCLIFF DAIRY: ONE OF THE BARNs

WATER SOFTENING

MR. WILLIAM MATTHEWS, M. INST. C.E., F.G.S., Engineer of the Southampton (England) Waterworks, recently replied to an inquiry from another English city as to the softening of water on a large scale in Southampton. We extract the following from a statement which, while mainly based on a single experience, is of interest to all who have excessively hard water to deal with. The gallon referred to throughout is the Imperial gallon, equal to 1.2 U. S. gallons:—

"Chalk waters are very easily softened, and with the most modern plant the cost for comparatively small quantities (such as that of a small town supply) does not exceed from one farthing to three-eighths of a penny [$\frac{1}{2}$ to $\frac{3}{4}$ cent], while for larger quantities the cost is from one-eighth to three-sixteenths of a penny [$\frac{1}{4}$ to $\frac{3}{8}$ cent] per 1,000 gallons.

"We started softening here in 1888, and have twice since then increased the output of the plant, until we can now soften over four million gallons per day. Recently we had to stop work for two or three months, in order to alter and improve the plant. This gave rise to a great deal of serious complaint that boilers and hot-water fittings were becoming blocked up with deposit, and that the water was unpleasant for use; the public notice the change at once, and resent the return to the

use of hard water. The water is reduced in hardness from 18 to 6 deg., below which we do not attempt to go, though it is possible to soften down to about $3\frac{1}{2}$ deg. At 6 deg. the water is quite bright and without any loss of taste, as the process we have adopted thoroughly aerates the water, and it is not insipid when drawn off for use.

"The South Hants Company, who supply a large district around here, have for many years softened by the old simple Clark's process, but have recently adopted, and since greatly extended, the 'Haines' system, which we use, at their new pumping station. The same system has been adopted by the Frimley and Farnborough Company, who have since enlarged, and are again about to increase their plant, as they find that the fact of the water being softened is a positive inducement to customers. The Bournemouth plant is also on the same lines, and will soon be completed."

From a comparative statement forming part of Mr. Matthews' letter, it appears that, while his city reduces the hardness from eighteen to six degrees of Clark's scale, one other deals with water originally as high as thirty-seven degrees (reduced to thirteen). This water is derived from the oolitic limestone, the remaining ten being from the chalk.

MUNICIPAL USE OF PATENTED ARTICLES

WE reported, in our January monthly issue (page 31) a decision of the Indianapolis Appellate Court in regard to the use, by municipalities, of articles which, being protected by patents, may be held to come within the category of monopolies. The question has cropped up in other places, the proposed use of Bitulithic pavement having given rise to several suits of this character.

In the case of *Prindle vs. City of Evanston, Ill.*, Judge Carter, of the County Court of Cook County, sustained a ruling of Justice Woods of the Supreme Court of Missouri in *Swift vs. City of St. Louis*, holding that the Legislature did not intend to prevent the use of patented articles in local improvements because of any monopoly on the part of the patentee. Judge Carter added:

"It has always been the policy of our government to protect for a term of years, by patent and trade-mark, the right of inventors or creators in their discoveries or inventions. It would certainly be an anomaly to pass such laws and then by other laws say that such discoveries or inventions could not be used by public authorities. Such a holding would prevent municipal corporations from availing themselves of advantages arising from thousands of inventions and discoveries that are constantly being made for our benefit. . . . The sustaining of this ordinance will not tend to foster or create monopoly. It will, on the contrary, tend to lessen the dangers of monopoly by opening a wider field of competition and in the end bring better results in the construction of paving.

THE GOOD ROADS MOVEMENT IN PENNSYLVANIA has been given an impetus by the work accomplished in the Abington section. A resolution has been introduced in the Council of Dickson City for issuing \$40,000 improvement bonds, while the officials of the city of Scranton and the boroughs of Blakely, Archbald, Jermyn and Mayfield are also giving attention to the subject.

CROWDED STREET CARS IN CLEVELAND are the subject of a new code issued by the Health Board of that Ohio city, providing that a car shall accommodate as many passengers as it can seat, plus half again as many. The Street Railway Company is ordered to post signs in the cars calling attention to the new rules. Arrests, to test the law on the subject, are looked for.

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It is also desired that the facilities furnished by the reference library in this office should be widely known and freely used by those interested in municipal affairs. Visitors will be welcomed and provided with conveniences for search, and inquiries by mail will be promptly dealt with.

NEW YORK, FEBRUARY 7, 1906

New York's Water Supply

In our issue of January 17 we drew attention, on page 70, to certain considerations bearing upon the proposed expenditure of \$161,000,000 in supplementing the water supply of New York City. In commenting, as we then did, upon the small amount of attention apparently paid to the factor of excessive waste, it was with no idea that even the most drastic measures of repression would suffice to render unnecessary large additional resources within the next quarter of a century. Consequently, no criticism of the Catskill scheme, as such, was made or suggested, but this conservative attitude has not commended itself to the State Water Supply Commission, whose first annual report to the Legislature, issued as we are going to press with the present number, uses the recent testimony on the New York scheme as a text for a sermon of wide application.

The Commission is impressed by the magnitude of a proposition which involves the taking of miles of watershed and the scattering of many rural populations. Admitting that the city must eventually utilize the waters of the Hudson River, the suggestion is thrown out, with sufficient plainness, that it is not an essential part of the process to go to the head waters for the desired supply. Progress in the methods of restoring rivers to a high degree of purity, chiefly by the diversion of sewage, is pointed to as offering at least an opening for New York to stop short in its gigantic proposals by tapping the river at a point immediately above the reach of tidal action. Reading between the lines of the report, it is not difficult to trace a belief in the possibility of converting waste repression into a powerful factor in tiding matters over until effective work has been done in the purification of the stream. "It may take years," we read, "to accomplish this work, but if it could be earnestly prosecuted now, and especially directed to the purification of the

largest waterway in the State, the Hudson River, it would be easier *twenty years hence* for New York City to obtain an additional supply of water from that great river."

The italics are ours. The cited passage opens up big possibilities in taking advantage of available experience in purifying sewage and in otherwise protecting water-courses from pollutions now largely regarded as being a matter of course. In the words of the report, "The questions of pure water supplies and the proper disposal of sewage are very intimately connected and may be considered of equal importance." The Commission believes that the danger accruing from the default of individual communities in so disposing of their sewage as to be harmless to themselves and others are inadequately recognized, and urges "the importance of protecting from pollution every well, water course and stream, as well as providing for the disposition in a sanitary manner of all sewage." These are weighty words, coming as and when they do, and we shall be little surprised by any consequences they may be the means of precipitating.

An Important Convention

WE direct attention to "the second conference of comptrollers, auditors, treasurers and others interested in the uniform classification of municipal accounts and comparable municipal statistics," which is to be held in Washington, D. C., February 13 and 14. The first of these conferences was held in the same city in November, 1903, since which time overwhelming testimony has accumulated as to the value, even the necessity, of placing municipal accounts upon a near approach to a uniform basis. The subject was discussed at the Toledo Convention of the League of American Municipalities last August, a valuable paper by Mr. L. G. Powers, Chief Statistician of the National Census Bureau, crystallizing the views of many thinkers on this topic. Mr. Louis Betz, City Comptroller, St. Paul, Minn., also dealt with this department of civic work in an address to the Union of Canadian Municipalities, at Winnipeg, last July. These utterances can be referred to on pages 95 and 160 of our September and October issues respectively, and may well serve as an introduction to the study of a subject daily growing in importance.

"Lost Leaders"

"To live in hearts we leave behind is not to die," must have been felt by many among the representative body which crowded the lecture hall of the New York City Club on the evening of January 24. Assembled to do honor to men, truly styled leaders by those whose privilege it was to dwell upon their characteristics and achievements, there was ample justification for objecting, as more than one speaker did, to the use of the adjective "lost" in connection with their revered personalities.

The Club, whose activity in civic reform needs no more than a passing allusion in these pages, was deprived, last year, of no fewer than four self-denying participators in work which has earned more than a national reputation. Two eminent lawyers, James C. Carter, the first President

of the Club, and Wheeler H. Peckham, President until within a few months of his decease, joined the majority within ten months of each other, closely following the death of William H. Baldwin, Jr., President of the Long Island Railroad, who was called in the very prime and vigor of life. Only a year older—forty-three—Norton Goddard also passed from among those who had learned to love him and who appreciated, to the full, the loss of one who had devoted his time and fortune to the comforting and elevation of others less fortunate than himself in worldly endowment.

Mr. John G. Milburn, in opening proceedings memorable in the history of the Club, referred to their synchronism with revelations of "sordid selfishness and low standards of morality in high places" which had left a sense of almost national degradation. Another allusion to the sinfulness of exclusive attention to money getting was apparent in the Rev. Thomas R. Slicer's statement that "to be simply rich is a terrible indictment." Utterances of this type are of hopeful significance at a time when, as is becoming more and more clearly recognized, the future of our cities lies with those who are beyond reproach in these respects. It is, we think, in that sense that these simple yet exalting exercises will be found to exert their most potent and lasting influence upon a community singularly fortunate in the possession of such a body—an influence, moreover, far from being limited by physical or geographical bounds.

Asphalt Pavement Prices

The Kansas City *Star* directs attention to the war now in progress on paving prices, illustrating its arguments by what transpired at the letting of a number of paving contracts in that city on January 18. The result of "open" specifications has been to admit the Cleveland Trinidad Paving Company, a new concern, which has been offering to do work at \$1.90 per square yard for which \$2.12 and \$2.12 had hitherto been paid. On the day named, however, The Barber Company bid as low as \$1.71 and the Parker-Washington Company \$1.77. Commenting on these changes, our contemporary writes as follows:

"There is no particular satisfaction in the heavy cuts made in paving prices in this city unless those who pay the bills know that the work will be inspected in such a way as to insure its quality. It should be assumed by the administration that the lower the bids the greater the need for competent and trustworthy inspection. Low prices tempt those who make them to save in the quality or the quantity of the material used, or in the character of the work.

"It is not necessary to distrust any or all of the companies doing business in Kansas City to make the strictest inspection the order. The history of open specifications in other cities has shown that with the lowering of prices due to close competition there has been a deterioration in paving, except where the inspection has been absolutely reliable. In most instances inspection has not been reliable.

"Competition is very desirable. It is really about the only way to insure fair play in business. But a competitive system has its dangers. There must be a trustworthy inspection. There must be ample and valid bonds covering the maintenance clauses of all paving contracts. Both of these points are very important."

While the *Star* does well to emphasize the value of local inspection, especially under the "cut-throat" system now being introduced, it is well to remember that other causes, beyond the ken of those merely standing over the actual work of laying, are at work in the same field. Some of these were referred to at the New York meeting, noted elsewhere in this issue, at which an Independent Asphalt Association was formed to meet prevailing conditions. It is not surprising that a drop in prices, from \$3.50 to less than \$2.00 per square yard within a few years, should have been accompanied by at least a corresponding depreciation in quality. The mixing of inferior grades is held by some to be largely accountable for this, but it is also true that poor laying must come in for its share of the blame. The Denver, Col., *Republican*, in a recent issue, referred to some asphalt paving, recently laid in that city, as being, in the opinion of the Board of Works, "the most unsatisfactory in the city." "Apparently, no effort has been made to preserve smoothness, and persons riding over it find themselves tossing upon a sea of waving asphalt in an entirely unexpected manner.

The 1-inch binder that covers the 2-inch asphalt is certainly not up to the standard. The heavy roller has driven all the binder and the 2-inch covering of asphalt on the concrete out of condition."

Other instances might be cited, but the remarks of the Kansas City *Star* display so clear an insight into the dangers of a situation in which mere cheapness is sought after that they can hardly be given too much prominence.

Good Roads in Michigan

THE Michigan State Good Roads Association was organized in Flint, January 25; one of the resolutions passed at the largely attended meeting referred to the Brownlow Bill, now before Congress, mentioned in our issue of January 17 (page 64) which, if passed will set apart \$702,000 for Michigan State roads. The meeting favored future distribution of funds among counties in proportion to their assessed valuations. Other resolutions urge coöperation between "Good Roads" organizations and with Federal, State and county officials.

It was also resolved "that international, State and county fairs should give premiums to the States and counties that give the best, most appropriate and dignified names to their roads, and that first complete their marking; to designers and builders of the longest, best and most beautiful roads, of model inter-capital, inter-county seat and inter-township center boulevards, of beautiful avenues along our lakes and rivers, and of country bridges."

The Association decided to publish a monthly bulletin. Mayor Todd of Jackson, was elected President.

AMERICAN PERIODICALS REVIEWED

Municipal Ownership in New York

The World's Work (New York, February) refers to the merging of all the transit roads on Manhattan Island—surface, elevated, and subway—into one "holding" company as being "perhaps the best aid that could be devised by the wit of man for Mr. Hearst's next campaign for municipal ownership, if he should ever make another. For here are millions of watered stock, dividends upon which must be paid by the public of the metropolis; here is a combination of capital and power and influence that must be reckoned with in all plans for the betterment and for the extension of facilities for travel in our largest city; and here is a sort of defiance of the people, who feel that the population which makes this travel profitable should get the benefit of the best possible facilities and the lowest possible fares, and especially that the people themselves should not be at the mercy of a stock-watered corporation. Municipal ownership might or might not, under other conditions, have risen soon again, but it will be heard now with increasing earnestness."

The Grouping of Public Buildings

THE *Chicago News* directs attention to plans now contemplated by several American cities, including Chicago, having for their object the purchase of great outlying systems of park lands. "In addition to these, several cities are making progress toward the realization of what are known as 'group plans'—elaborate schemes for the grouping of monumental public buildings around a great central mall or court, in conformity to some studied general design. These plans, when completed, will add nobility and distinction to the centers of cities, introducing there some of the element of beauty usually found only in the best residence districts.

"The development of these projects promises to be one of the most interesting phases of municipal activity in the future. In Washington, where a Government Commission has been at work on the designs for three years, an ambitious scheme has been sanctioned providing for the grouping of public buildings on or near a great avenue 900 feet wide. Cleveland is actually completing a plan—once declared to be 'ideal but impossible of fulfillment'—which was suggested by the Court of Honor of the Chicago World's Fair. A mall in the heart of the city will be surrounded by Government buildings, local and Federal, all to be designed with an eye to balance and proportion and uniformity of effect. St. Louis, following Cleveland's lead, is proposing to establish a great municipal court on which to place its public structures. St. Paul, which recently secured a beautiful State Capitol, proposes to make it the central feature of a similar group. In Buffalo, a triangular area has been marked off for the same use, while Philadelphia is considering a similar group of buildings on its Fairmount Park parkway."

Civil Service in San Francisco

Municipal Affairs, the monthly organ of the Municipal League of Los Angeles, expresses, in its December issue, the opinion that the people of San Francisco have to thank the Merchants' Association of that city for the fact that the merit system is not yet entirely obliterated. "The charter provides for as complete a system of merit examinations and appointments as exists in Los Angeles, but the present Mayor has done everything in his power to nullify and destroy it. He appointed machine politicians of the lowest type on the Civil Service Board, and for a long time no examinations were held. The places were filled with employees selected in defiance to the charter, and the spoils system was in a fair way to return to its old status in the city government. The Merchants' Association employed able counsel and went to work fighting off the illegal appointees and forcing the Commission to do its duty. Of course, it is impossible to successfully administer a merit system at the point of a law process, but the principle can, nevertheless, be maintained, and the law kept alive until better times come. Recent suits successfully prosecuted by the Merchants' Association cover forty-three appointees with a salary list of \$7,000 a month. Fortunately, the merit system in Los Angeles has been thus far in the hands of its friends."

Minor Engineering Societies

The Engineering Record (New York, January 6) discusses the reasons which deter young engineers from applying for admission to the great engineering societies. Among these are the feeling against the discrimination attaching to membership of the junior grades, the high admission fees and annual dues, and the cost of attending conventions at a distance. Part of the article is as follows:

The young engineer needs professional intercourse with his fellows to broaden his views and increase his knowledge. He wants to try his wings, and he needs the kindly helping hand of older men, who know something about him and are interested in him, to guide him in his first efforts. One cannot learn to swim without going into the water; and so the young engineer who, for any of the reasons given above, is not able to bring himself to join one of the larger societies and take part in its proceedings, might, if dependent upon those societies alone, be compelled to get along for years without that practice in written and verbal debate which is so essential to perfecting his attainments. Just here lies the best field of usefulness of the minor engineering society. Many of these societies are State organizations and for convenience they may be here classed as such, to distinguish them from the larger or national bodies.

The State society offers to the young engineer, at merely nominal cost, just what he needs. Its conventions are short and always within easy reach, its dues are small, and its requirements for admission are de-

signed to exclude only those whose personal characters or habits are objectionable. Its membership is relatively small and is made up of men from one State, all of whom have something in common and most of whom know each other. In each of these societies there are usually enough men of high reputation and attainments to give a good tone to the gathering; and these men always stand ready to make the young engineer feel at home and to draw out the best that there is in him. His papers, when he reads them, will be listened to with more attention than he could expect in one of the national societies, and will be discussed with that kindly consideration for their short-comings which can come only from personal interest in the author. The State engineering society, therefore, offers to the recent college graduate an excellent post-graduate training, and for this reason deserves, and usually receives, much encouragement from those broad-minded professors whose interest in their pupils does not cease with the signing of their diplomas.

The Ownership Investigation

The Electrical World and Engineer (New York, December 2) refers as follows to the investigation now being conducted, by the National Civic Federation, into the municipal ownership question: "The idea of this investigation is that formulated recently by Mr. W. H. Blake when he said before the New York State Street Railway Association: 'If our present system of caring for public utilities is wrong, the sooner such a situation is realized the better; if it is right, every good citizen should be placed in a position to conscientiously uphold it.' In other words, what we all need is the facts of the case. The arguments pro and con as theories, opinions, views, politics, etc., are pretty well known; now is the time for real data. The Federation committee will now proceed in its inquiries upon just that line, here and in Europe, determining from the accountant and actuarial standpoint just what there is in municipal ownership. It may take time to accumulate such data, and some money, but neither time nor money will be wasted if the sub-committees do their work as thoroughly as the membership would indicate and promise. At any rate we are likely to be spared in future some of the fuss and fury of the late Hearst campaign."

The Decay of Individualism

The Globe (New York, January 31) commenting editorially on the opposition evoked by the proposed merger of passenger traction interests in that city, directs attention to the benefits directly due to "the enlargement of the physical unit of greatest industrial efficiency. . . . In transportation the unit has grown from the single coach or wagon to great systems carrying millions of passengers. As to public utilities such as gas, telephone, and traction companies, it has been demonstrated that the unit of greatest efficiency is a system co-equal with the population served. Monopolization pro-

duces more cheaply than competition, and regretfully we have been compelled to surrender the notion that as to some things the principle of competition is a finality. Instead of a street railway monopoly being necessarily and in itself an evil the presumption is that it is a benefit, holding out the hope of cheaper fares and better service. . . . If a tithe of the energy that has been foolishly expended in idle denunciation of monopoly had been sensibly employed to secure such a corporation law as Great Britain and Massachusetts possess we should have less complaint of stock watering—of the creation of securities that it is understood the people are hereafter to inject value into."

Labor Union Tyranny

Engineering News (New York, January 11) comments upon the attitude assumed by the labor unions of Essex County, N. J., in opposition to the growing use of concrete as a constructional material. The rules now in force, the result of successful dictation by unionism, provide that concrete must be mixed and placed by men classed and paid as masons' helpers. Not content with this, the bricklayers in Newark, the largest municipality in the county named, "insist on placing all concrete themselves, to the exclusion of stone masons. But this seems too unreasonable for belief, or at least to have any promise of being carried to a successful issue, for it is not likely that the stone masons will allow the bricklayers to monopolize concrete work. Leaving out of account the controversy as to whether brick or stone masons place concrete, the practical effect of the new rules, in some of the smaller municipalities of Essex County, is to advance the labor cost of concrete from \$1.75 to \$3.20 per day for mixing and for moving to place, and from \$1.75 to \$5.00 per day for putting it in the wall. The prices given are the wages for an eight-hour day, paid to ordinary laborers, to mason's helpers and to stone masons, respectively, allowing for contractors' profits. Union rules aside, as our readers well know, common laborers can do practically everything required on concrete work, under the direction of a competent but not high-priced foreman. Everyone interested can estimate for himself, in accordance with local conditions, the great increase in labor cost due to excluding common labor from concrete work and to insisting upon having a mason place the concrete in the forms. The principle at stake, obviously, is an attempt, already successful in some quarters, to dictate, virtually, whether one material or another shall be used in building construction, and if a choice is exercised by the owner to compel him to pay an unnecessarily high price for it. The new rulings differ little in object and effect from the old efforts, unfortunately not yet ceased, to prevent the substitution of machinery for hand labor. They cannot and should not succeed in this case any more than in that, for in each they are against economic progress and individual liberty alike, increase the cost of living generally, and thus and in other ways militate against the interests of the very men who try to make and try to enforce such restrictions."

How Not to Do It

The American Architect (New York, January 27) comments as follows upon a method of school ventilation of which, unfortunately, New York does not hold a monopoly:

"Recently the New York Board of Education issued an order to the effect that the school-teachers should no longer undertake to ventilate their class-rooms by opening windows when conditions seemed to require it, the reason for the order being that the schools were now ventilated by some mechanical apparatus, and, moreover, the opening of the windows was wasteful of heat and caused an increase in the coal-bills! Naturally the teachers, who know what the conditions actually are, protest vigorously, and if the facts are as stated the ventilating device, whatever it is, is certainly not properly installed. In one case the inlet-shaft, which has its opening only four feet above the pavement! is placed in a re-entrant angle of a court where, the school being near a market-house, dust and orange-wrappers are seen constantly eddying about as high as the fourth-story windows. Here, though the rooms are dusted twice a day, one can at twelve o'clock write one's name in the dust upon a desk that was dusted at ten. In this building is the Training School for Teachers, and the record of deaths from quick consumption among these well-grown pupils is said to be startling. The engineer in charge of the apparatus says that "the quantity of dust is so enormous it would clog cotton filters in an hour and stop the fans, and one man would have to spend his whole time changing them." Probably a man's time could not be better employed—that is, if the inlet must be just where it is and only four feet from the pavement."

Frozen Fire Hydrants

Insurance Engineering (New York, October) refers to the "thousands of fire hydrants found frozen during the winter of 1904-5, causing delays in fighting fires that cost hundreds of thousands of dollars additional property loss," this description of the result being abundantly justified by a tabulated statement of representative cases. "The commonest cause of freezing seems to be carelessness in not draining fire hydrants before freezing weather begins, and also each time they are used at fires during the winter months. In New York City, where thousands of fire hydrants are found frozen every winter, one of the chief causes of freezing is the fact that other departments than the Fire Department are allowed to use the fire hydrants. Many of the hydrants are also old style—'antiquated.' . . . Electricity was used extensively during the winter of 1904-5 for thawing frozen water pipes, public service corporations finding this work a profitable source of revenue. Special transformers are made for this purpose. As high as 2,000 services have been thawed by electricity in a single city. A 10-inch pipe 800 feet in length has been thawed in two hours with a current of 70 volts and 400 amperes. Thawing with electricity is quicker and cheaper than digging up the ground."

Sewage Treatment

THE adoption of sprinkling filters for sewage purification at Columbus, Ohio, was recently commented upon by *The Engineering Record*, in a spirit of compliment to the section of country in which two sanitary novelties were first experimented upon and adopted. "Just as Louisville adopted mechanical filters because the raw water was not suited for treatment by slow sand filtration, so Columbus has been forced to break away from intermittent filters for sewage because the local conditions would render them very expensive and their results little if any better than those of the system adopted. . . . The sprinkling filter is a decided novelty in this country, although in Great Britain, where it is known as the percolating filter, it has been employed for a good many years. It is an improvement on the contact bed for some purposes, although just how wide its applicability may be is not definitely known. Its fundamental merit is its high rate of operation, which enables works of large capacity to be constructed on a limited area, as compared with the much greater areas needed for intermittent filtration. Another and hardly less important merit is the fact that the beds are composed of coarse stone readily found in most localities, while really good sand for intermittent filtration is not easily obtained in many parts of the country."

New Standards

Collier's Weekly (New York, January 27) refers as follows to the time "requisite for the growth of an idea . . . in the individual and in the community alike": "Just now America seems to be undergoing a peculiarly rapid education in the direction of duty toward the public. What is called the campaign of exposure, or the year of reform, means only that people are learning to look upon as seriously wrong certain things that they have tolerated before. That it is wrong to use public office to pay private debts; or to get rich by selling poison in the guise of medicine; or to divert the profits of a life-insurance business from policyholders to directors; or to give away public franchises; or to permit private greed to destroy a beautiful national possession like Niagara Falls: all these are ideas which have been showing growth, and are much larger and stronger to-day than they were even a year ago. Really, moral standards are made by applying fundamental ethical principles to the situation which confronts us, with honesty and courage, and no country, unless it may possibly be Japan, is showing more willingness than ourselves to turn moral maxims into actual living factors in treating questions which are imminent and important."

Wet and Dry Concrete

The Engineering and Mining Journal (New York, January 20), in the course of a pithy article on "Mixing Concrete," by J. H. Robinson, deprecates the excessive wetness of this material which is favored by contractors and by the terms of some engineers' specifications. The following extract from this excellent contribution indi-

cates its general tenor: "One reason for the preference shown for wet concrete by some contractors is the fact that, with mixtures of this character, it is easy to conceal botchy work. A common practice in such cases is the use of a flattened shovel, which is shoved up and down along the inside edge of the forms as the concrete is placed. This is, often, all the ramming that such concrete gets; it is too wet; and the very fact that a shovel may be introduced and kept in motion to the extent it is done is proof of a too wet or too thin mixture. The appearance of the resulting structure is good; the finished surface of the concrete is smooth, and the corners are sharp. But the interior! Let the engineer break into and examine *one* mass of concrete that has been laid in this manner. He will be apt, thereafter, to insist upon *dry* concrete; for, however much more trouble it may be, when thoroughly mixed dry concrete is rammed until the water flushes to the surface, it is proof positive of good work. And yet dry concrete, if not properly mixed, is as apt to produce a botched job as the wet, *only* the dry concrete shows the imperfections on the surface, and one is not lulled into a false sense of security by the fine appearance of the outside."

Trade Unionism

The Improvement Bulletin (Minneapolis, January 6) refers to an example of trades union interference at Great Falls, Mont., where a railroad corporation wished to put in water and sewer connections for its station. "The company has excavated a trench six feet deep through solid rock, using its own men for the work. The company also purchased the pipe and other material for the work East, and shipped it in, and the plumbers' union rules provide that materials shall be secured through local houses. Hence the master plumbers will not figure the work, for their men would not put in the pipe in trenches dug by non-union men. The company cannot put in the plumbing work by its own labor, because the city ordinance requires all plumbing to be done by licensed plumbers. Apparently, the only way the company can proceed in the matter is by giving to some local firm a contract for the furnishing of the pipe, as well as the work in laying it, or else to bring plumbers in and secure for them a license from the city. In that event, however, it is said that the visiting plumbers will have to become members of the local union, in which case they can be called off the work if the railroad company insists upon putting in the foreign pipe. The whole matter is one which shows up the beauties of the closed shop and of quasi-partnership arrangements between employers' associations and unions."

Housing in Chicago

Charities and The Commons (New York, January 6) deals with "Chicago Housing Conditions" in an illustrated and suggestive article by Sadie T. Wold. Replying to the query, whether housing conditions in that city "have improved since the first scientific presentation of

them by the City Homes Association in 1900," the writer states that "the city has no tenement-house department. The authority for regulating tenements is divided between the Building Department and the Department of Health. Our chief sanitary inspector, though not yet legally appointed, is daily acquainting himself with local conditions, and recognizes the truth of the report of 1900 that, 'unpaved and unclean streets, dangerous sidewalks, neglect of garbage disposal and removal, rubbish and refuse upon open spaces, the outlawed privy vaults, houses unfit for habitation, damp basement dwellings, overcrowded, dark, and unventilated rooms are not inevitable or necessarily permanent evils.' . . . For the most part we have had a certain self-satisfied assurance that because we have not the five-story tenement of New York, we have no housing problem. But we have a problem and a very serious one, and it is by no means confined to the small house. The result of the well-planned campaign of 1900 was not only a great surprise to those who were directly interested in the neighborhoods investigated, but its report was a forcible word of warning to the whole community. True it is, 'that through knowledge has come responsibility and hope, and through both action,' for from this report developed a tenement-house ordinance governing the construction of new buildings, which was added to the Building Code in 1902—an ordinance that made provision, first, against fire; second, for sufficient light and air; third, for proper sanitary regulations."

Articles in American Publications

The Street Railway Journal (New York, January 6) has a ten-page illustrated article dealing with the "Expert Report on San Francisco's Street Traffic Problems," in which the principal features of Mr. Wm. Barclay Parsons' plan for the development and improvement of the city's transportation and street traffic facilities are lucidly presented.

The Electrical Review (New York, December 30, 1905) contains an illustrated article on "The Buildings of the National Bureau of Standards," for which an appropriation of \$325,000 was made in connection with the establishment of the Bureau by Act of March 3, 1901.

Engineering World (Chicago, January) discusses, in an article by Waldon Fawcett, the system of electrically-operated long distance overhead conveyance known as telpherage, which is obtaining increasing favor in the industrial world.

The American Architect (New York, January 6) has some excellent "Notes on Reinforced Concrete."

THE BUFFALO, N. Y., PARK BOARD, after operating the Department for the past four years at a cost, represented by last year's expenditure, of \$141,000 a year has asked the Common Council for an appropriation of \$216,000 for the present year.

FOREIGN PERIODICALS REVIEWED

The Population Question

The Sanitary Record (London, December 28, 1905) summarizes an interesting analysis of the causes contributing to the decline in the birth-rate, recently presented to the Royal Statistical Society by Dr. Arthur Newsholme, Medical Officer for Brighton, and Dr. T. H. C. Stevenson, Assistant Medical Officer of the Education Committee of the London County Council. "It was stated that fertility was undoubtedly lower in the higher social strata, and diminished in many communities with increase of prosperity. In England and Germany, as well as in other countries, the birth-rate had declined with general increase of social comfort. Ireland was the only country in which, with some probable increase of welfare, the birth-rate had increased. The decline of the birth-rate was associated with a general rising of the standard of comfort, and was an expression of a determination of the people to secure greater comfort. It was not caused by greater stress in modern life. It was pointed out that with the decreasing birth-rate in England and Wales there has been no reduction of infantile mortality, and that it was by no means certain that children would be better reared because less numerous. The 'gospel of comfort' had been widely adopted, and was becoming the practical, ethical standard of a rapidly increasing number of communities both here and abroad. With that 'gospel' a lower standard of moral outlook, a lowering of the ideal of married life, and a consequent deterioration of the moral, if not also of the physical, nature of mankind must be looked for. The outlook was gloomy, and one could not look with confidence to the help which was likely to come either from preaching or medical teaching."

Steam Distribution

UNDER this caption, Mr. A. E. Collins, City Engineer of Norwich, England, writes as follows in *The Contract Journal* (London) of December 20, 1905:—

I think the following information may be of value to such municipal engineers as happen to be engaged in any scheme entailing the distribution of steam. It has been arrived at as the result of an experiment carried out by me to ascertain whether it would be worth while incurring the expense of cladding steam-pipes laid in approximately air-tight stoneware pipes buried in the ground. The experiment was carried out in the following manner: A 12-in. length of 1-in. iron steam-pipe was laid in the center of a 6-in. stoneware pipe at a depth of 2 ft. below the surface of the ground. The pipe had a fall of 1 in 50 to an automatic steam-trap at the end and remote from the steam inlet. The stoneware pipe was jointed and closed in at the ends, so as to make it approximately air-tight. An exactly similar length of pipe laid under identical conditions was constructed 6 ft. distant from the line first described, but this latter steam-pipe was clothed with Leroy's non-conducting composition to a

thickness of 1½ in. The two pipes were connected at the steam inlet end, and steam supply was laid into the connecting pipe in such a manner that the water of condensation was thoroughly drained by an automatic steam-trap before entrance thereto. Steam was turned on and maintained in the pipes at an average pressure of 80 lb. on the square inch for forty-eight hours continuously; at the end of this period it was found that the uncladded pipe condensed 25 lb. of water in two hours, whilst the cladded pipe condensed 19 lb. in the same time. The automatic drain traps were changed over, when the results were practically the same, showing that the loss of heat is 31 per cent. greater in the case of uncladded pipe than when cladded pipes are used, even when both are contained in almost air-tight buried stoneware pipes in the manner detailed herein.

An English View

The Municipal Journal (London, January 12), commenting on "The Situation in New York," refers to the fact that a change in all the electoral districts, corresponding to that made by the recounts in four of them, would lower Mayor McClellan's "official majority" of 3,549 into a minority of about 5,000 and place Mr. Hearst in City Hall. Looking at the possibility of further action by the latter, our contemporary adds:

"Meanwhile there is considerable evidence that the character of the election has greatly chastened Mr. McClellan, and, fortified by public opinion and the fact that he now has four instead of only two years' rule before him, he is likely to be more independent than ever of Tammany Hall. He has been remarkably successful in the past in keeping his own record clean, and it is expected his nomination of chief subordinates this year will tend to bring about an increasingly efficient administration of the principal departments of the city's government. Mr. Hearst's narrow escape of victory was a striking tribute to the progress of the municipalization principle in America, and it is probable the movement will gain rather than lose by thus, for the time being, stopping short of success. A triumph would have found the party but ill-prepared to give effect to their programme, and another few years' active propaganda will be of immense educational value, and will find the reformers ready to make a practical application of their principles."

Engineering (London, December 22, 1905) has an interesting article on the "Ventilation of the Baker Street and Waterloo (London) Underground Railway by the Exhaust System." The electric fans installed are capable of withdrawing one million cubic feet of air per hour, sufficient to renew all the air in the average length between the stations, in both tunnels, every thirty minutes.

ELECTION REFORM

EX-GOVERNOR L. F. C. GARVIN, of Rhode Island, in a specially contributed article to the *Cleveland Press*, characterizes the election of numerous officials on the same day as a defect of our government, which needs to be remedied. "Voters generally," he observes, "will not give the time required to learn the qualifications of the competing candidates for ten, or even five, offices to be filled at one election."

"Moreover, a very small minority of those who go to the polls are sufficiently acquainted with the duties appertaining to the several offices to feel sure of electing to each the better of two candidates."

"In practice, the selection of public officials has devolved upon party caucuses and conventions, whose choice, whether bad or good, is usually ratified by the members of the victorious party."

"And yet it must be said that election by the people of officials, whether one or many, is to be preferred to election by such legislative bodies as are now found in our cities and States. Those State constitutions which forbid elections by legislative bodies are wisely framed."

"Appointment by the chief executive, however, is a very different matter. Our republican government has achieved its greatest success in the election of chief executives, National, State and municipal. Very rarely does an untrustworthy man reach either of these positions. And the greater the responsibility attached to the office, the more certain it is to be ably filled and scrupulously conducted."

VOTERS CANNOT KNOW

"With subordinate executive officials, who are elected by the people, the case is different. Their qualifications are not, and in fact cannot be, so thoroughly scanned by the voters; and the difficulty increases rapidly as their number augments."

"Dr. Chas. E. T. Clark, in his little book, *The 'Machine' Abolished*, speaks of having voted at an election for forty officials, every one of the candidates being wholly unknown to him. Under such circumstances many inferior and unfit candidates are sandwiched in among the good ones."

"The federal plan is the best we have in operation in this country. Every four years, on the Tuesday next

after the first Monday in November, each voter practically casts his ballot for three officers only, namely, for the President of the United States, for his substitute, the Vice-president, and for Congressman. Two years later he votes to fill a single office only, that of representative in Congress. If to this list were added, twice in every six years, the election of a United States Senator, all that is reasonable would then be asked of the millions of voters who go to the polls in November of the even years."

"State elections should be held in November of the odd years, and ought to present fewer rather than more offices to be filled. The federal system should be applied likewise to municipal elections, to be held in some other month than November."

THE IDEAL PLAN

"The ideal plan would be for one office only to be filled at each election. This ideal is attained in electing the members of the British House of Commons."

"In Great Britain the Prime Minister in effect, and the mayors of cities are chosen by the legislative departments of the Imperial and municipal governments, and it works well there. The reason for its success is that the legislative bodies in their cities certainly are vastly superior to corresponding bodies in this country."

"If our legislatures, National, State or municipal, were perfectly representative of the people, the plan which has proved so successful in Great Britain could be adopted here."

"In the United States, chief executives have from the beginning been elected by the people. Practically, therefore, in this country at the present time, the offices to be filled at an election cannot well be fewer than two, to wit: that of chief executive and that of legislator. A lieutenant-governor is wholly unnecessary, as useless to a State as a Vice-Mayor would be to a city. Just as the Chairman of the Board of Aldermen gives entire satisfaction as a substitute for the Mayor in case of need, so the President of the State Legislature may fill the office of Governor in the absence of that official. These business officials, such as a State Treasurer or Secretary of State, may very properly—like State judges—be appointed by the Governor."

A THIRTY-YEAR FRANCHISE FOR CITY LIGHTING, granted to the Southern Light and Power Company, has been approved by Mayor Woodward, of Atlanta, Ga. The franchise ordinance provides that the company shall not charge more than \$65 annually for arc lamps or \$28 for incandescents. It fixes 10 cents per kilowatt hour as a maximum charge for current light and 6 cents as a maximum charge for current for power, with a discount of 10 per cent. for bills paid before the tenth of the month.

THE ANNUAL REPORT OF THE PLAINFIELD, N. J., Board of Health deals largely with the question of garbage disposal. President Fisk urges the importance of a proper and sanitary system for the collection and disposal of garbage, as a matter which cannot be too forcibly brought to the attention of the public. The report recommends an appropriation to enable the Board to abate existing evils. The general health of the city stands above the average for several years past, and sanitary conditions show marked improvement.

WATER FILTRATION AND PURIFICATION AT NEW ORLEANS

By John Lewis Porter*

THE Mississippi river has been used as a public water supply in New Orleans since 1836, but its muddy character and high price have restricted its utility principally to fire protection, street and gutter flushing, and lawn sprinkling, most of the population using rain water caught and stored in wooden cisterns above ground. In 1892 the Water Works Company attempted to filter the water by the use of mechanical filters of the direct pressure type, interposed between the pumps and the distribution system. Under this arrangement the coagulating chemical (sulphate of alumina) was added to the water as it left the pumps and just before it reached the filters. There was practically no time for the necessary reaction with those constituents of the water which set free the active coagulant, and no time or place to allow the heavier and more easily coagulated sediment to deposit before reaching the filters. As a result, the filters were clogged with mud so rapidly that a large part of the water was consumed in washing them by back pressure; even raw water had to be resorted to for washing purposes. The quality of the effluent was not satisfactory as to appearance, the lack of proper coagulation making it impossible to prevent the passage through the filters of some of the finer particles of clay, rendering the effluent more or less turbid. This method was also open to the objection that undecomposed chemical would sometimes be present in the filtered water. As a result of these conditions the scheme was abandoned and no further attempts were made by the Water Company to improve the quality of the public supply.

Experimental investigations which had been carried on at Louisville and Cincinnati from 1897 to 1899 showed the possibility of removing the sediment from waters of similar character by due regard for certain definite characteristics of those waters, besides revealing the reasons for failures such as had occurred at New Orleans.

It was early recognized that in order to effect any economical removal of the sediment, a proper division of the work must be made, as follows:—preliminary subsidence in basins of ample capacity to remove the heavier and coarser materials, followed by the application of the proper amount of coagulating chemical, basic sulphate of alumina containing about 18 or 19 per cent. of available alumina (Al_2O_3) being the one used almost exclusively at that time, with auxiliary subsidence for a period long enough to enable the chemical to react with the alkaline constituents of the water to form the active coagulant, and then for the coagulated masses to be precipitated until there was but a small, though sufficient, amount of coagulated clay particles left to form a coating on the surface of the filters, sufficient to retain the rest of

this mud together with the bacteria present in the settled water.

During the later part of 1900 and the early part of 1901 an experimental water purification plant was equipped and operated by the Sewerage and Water Board of New Orleans, under the direction of Mr. Robert Spurr Weston, Resident Expert, and Mr. George W. Fuller, Consulting Expert, assisted by a corps of trained assistants, to study the character of the river water at New Orleans, to determine the relative merits and costs of several different methods of treatment, and the most economical division of the work.

This plant had a capacity of about 100,000 gallons of filtered water per twenty-four hours and was provided with three different combinations of treatment arranged in four different systems, providing for a wide variation in time of treatment as well as the method of filtration.

The systems experimented with were (1) of the English or slow sand type, using plain subsidence only up to three days' period and then filtering through a bed of fine sand (.0083-in.) at a rate of two and one-half million gallons per acre per twenty-four hours; (2) the modified English, using a comparatively long period of subsidence with a small amount of coagulant, followed by filtration at a rate which, technically "slow," was more rapid than in the case of the usual English type, five million gallons per acre per twenty-four hours passing through a bed of coarser sand (.015-in. to .012-in.); (3) the American or rapid mechanical systems, where the water is filtered at a high rate through sand beds after a preliminary plain subsidence followed by coagulation and auxiliary subsidence. Various periods of time, from three to forty-eight hours, were tried for each step and the results carefully worked out and tabulated.

The detailed results of this investigation, as given in the report of the Resident Expert to the Sewerage and Water Board and since published by it, showed as follows:—

First: That apart from the mud which the river water carried in amounts varying from 60 to 2,500 parts per million and averaging about 650 parts per million, the water was remarkably pure and admirably suited for a municipal supply, though somewhat hard. In about a hundred tests for *coli communis* made during the investigation, using from 1 to 300 cubic centimetres and concentrating the larger amounts in a centrifuge before seeding, its presence was demonstrated but three times and other pathogenic forms were absent. The total average bacteria were 2,000 per cubic centimetre. It was early shown that any method which would satisfactorily remove the turbidity would give a sufficient bacterial purification and the problem became one of finding the best method of

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effecting the removal of this turbidity, which is a big engineering problem in itself, there being an average of $2\frac{1}{2}$ tons of mud to be removed from each million gallons of water, or about 100 tons per day for the 40,000,000 gallons required by this city.

Second: That the English or so-called slow sand filtration method, after even three days of plain subsidence without the addition of chemicals was not applicable here, both on account of cost and the quality of the effluent, it being impossible to obtain a perfectly clear effluent by this method.

Third: That preliminary subsidence of the river water to remove the coarse sediment, followed by an application of coagulant—sulphate of alumina—the water being then allowed to remain in basins for a further period of subsidence until the turbidity was reduced to a small amount, rendered the water capable and easy of filtration by either the slow sand (modified English method), or by the rapid American or mechanical type of filters.

In comparing the different factors of cost and operation it was found more economical to build and operate the mechanical or rapid type of filters.

In studying the effect of different periods of plain and auxiliary subsidence, taken in connection with the cost of coagulant, wash-water, etc., for the mechanical type of filters, it was found that the most economical arrangement was for twelve hours' plain subsidence followed by the addition of the proper amount of coagulant, with thorough mixing, and a further subsidence period of twelve hours, when the water was adequately prepared to go to the mechanical filters for final purification.

It was also found that the most economical operation of the filters resulted when the turbidity of the coagulated water was from fifty to seventy-five parts per million, and this turbidity was to be insured by the addition of the proper amount of chemical, approximately proportional to the turbidity of the settled water.

Plants in operation at Quincy, Ill., and Lorain, O., operating with mechanical filters but using a combination of lime and a salt of iron, principally ferrous-sulphate, have been in more or less successful operation for several years, for removing suspended matter and bacteria. In this treatment just enough of iron and lime are used to react with one another and to coagulate the suspended matter. This method of purification, while it could be made to give a perfectly clear and satisfactory effluent bacterially, did not reduce the hardness of the water at all. But since the close of these investigations, in 1901, the desirability of softening the relatively hard waters of the South and West has led to extended investigations in these cities as well as at Columbus, O., St. Louis, Mo., and New Orleans, and the result of these studies is seen in modifications of the method of treatment in several important particulars.

The principle on which the efficiency of coagulants is based is the entangling and gathering together into more or less colloidal masses of the microscopic and sub-microscopic clay particles by the precipitants set free through the interaction of the coagulating chemical and the alkali

line constituents of the water either normally present or added thereto.

In the case of the hydrates of iron and alumina this precipitate is very flocculent and bulky and the segregation of the particles of clay is very rapid and efficient.

In the application of the softening treatment using lime and iron sulphate, use is made of the "Clark" process based on the fact that calcium carbonate is very slightly soluble in water free from carbonic acid, and that magnesium hydrate is practically insoluble. Milk of lime added to the water in sufficient quantities to react with the free and half bound carbonic acid, and to change the carbonate of magnesium to the hydrate, precipitates itself as carbonate of lime, withdrawing also the carbonate of lime and magnesium which had been held in solution by the carbonic acid, down to the limit of solubility of calcium carbonate—about thirty-five parts per million.

The precipitate of calcium carbonate is of a crystalline nature and much denser than the iron or alumina precipitates, while the precipitate of magnesium hydrate is quite flocculent. It is larger in amount, however, and separates out much more rapidly and exerts a very similar entangling and collecting effect to that of the more bulky coagulants.

The rapidity of the reaction of the lime with the carbonic acid of the water and its consequent precipitation is largely dependent upon the temperature of the water, the reaction being completed in fifteen or twenty minutes with a temperature of 80° F., while several hours are required when the temperature is about 40° F.

Experiments made in New Orleans have shown that in some cases, with certain types of water, the final clarification is materially assisted by the addition of small amounts of sulphate of iron, say from $\frac{1}{2}$ to $1\frac{1}{2}$ grains per gallon. On the other hand, the treatment of lime is so effective in some cases that clarification is carried far enough to require the addition of a small amount of ferrous sulphate to form a sufficient coagulum to render the filters bacterially efficient.

In the proposed plant for New Orleans the detailed method of treatment is as follows: The plant is to be located at the upper end of the city, about eight or nine miles above the sewer outlet and well above the influence of local shipping and about 4,000 feet back from the river. The water as drawn from the river by the low lift centrifugal pumps will be allowed to settle for one hour in grit chambers to remove the heavier particles; it will then receive a treatment with a milk of lime solution sufficient to react with the free and half bound carbonic acid gas present in the water, as well as to combine with and change the relatively soluble magnesium carbonate to the insoluble hydrate. The water will then pass through a mixing chamber, where it is kept well agitated for about one hour to allow the milk of lime to become dissolved and thoroughly mixed with the water before it has a chance to settle out. Thence, the water will pass to settling basins where it will remain for about seven hours to allow the precipitated calcium carbonate, magnesium hydrate and the entangled particles of clay and bacteria to settle out. About ten minutes after the

addition of the lime, soda ash is added in sufficient amount to react with the incrustants in the water, principally the sulphates of calcium and magnesium. The coagulating reservoirs will be provided at points corresponding to $1\frac{3}{4}$, $3\frac{1}{2}$, $5\frac{1}{4}$ hours with the means of applying more lime, sulphate of iron or sulphate of alumina to complete the treatment or of raw water to correct for over-treatment.

From the coagulating reservoirs the water will pass to filters of the American rapid type, through which it will pass at the normal rate of 125 million gallons per acre per twenty-four hours, the sand bed being about three feet deep. There will be ten units of 4 million gallons daily capacity each, thus providing a normal daily supply of 40,000,000 gallons. The whole plant is so arranged as to be capable of a 50 per cent. overload.

The filtered water will flow through automatic controllers, regulating the rate of filtration, to collecting reservoirs, from which it will be pumped to the distribution system. The pressure will be maintained by means of balanced valves, any excess flow passing back to storage reservoirs.

All parts of the plant and all steps of the process are to be under the supervision of trained men and as far as

possible all regulation of rate of application of the several chemical solutions is automatic.

The estimated average amount of chemicals required, based on the normal composition of the water, is as follows: Lime (CaO) 6.5 grains per U. S. gallon; carbonate of soda, 3.0 grains per gallon; sulphate of iron, 1.0 grain per gallon.

With the turbidity of the coagulated water at about fifty or sixty parts per million, these filters will require washing about twice every twenty-four hours and will absorb, for washing, about 4 per cent. of the total volume filtered. The washing is effected by passing a current of filtered water upward through the filters at from five to ten times the normal rate of filtration, either with or without the simultaneous application of compressed air to loosen the sand layer and free the sand grains from the adhering particles of mud, bacteria, etc.

By this system the water is prepared for filtration with about the same ease and cost as by the sulphate of alumina treatment alone, with the added advantage of reducing the temporary and permanent hardness from an average of about 120 to about 40 parts per million, thus rendering the water much more satisfactory for domestic and manufacturing purposes.

MUNICIPAL ASPHALT WORKS IN DETROIT

ASPHALT paving under municipal ownership and operation was so pronounced a success in Detroit during the season of 1905 that the city's plant, now well past the experimental stage, is to be doubled in capacity. Not only was asphalt re-surfacing done much cheaper than the same work under the contract system, but the cost was brought very greatly below that of brick, while, taking durability into account, it rivaled cedar in cheapness.

The Detroit plant was installed and operated to a comparatively small extent in 1904, but during the past season the asphalt re-surfacing done amounted to 51,250 and the patching to 11,601 square yards, or a total of 62,851 square yards. For the season of 1906 something like 100,000 square yards of re-surfacing will be done, and the prospects are that within a few years the city will lay all its new asphalt paving as well.

The elimination of politics has been a feature of the municipal plant's history. When the administration of the Public Works Department was changed last summer, Jacob J. Haarer, the incoming Commissioner, recognized the necessity of a non-partisan attitude and made competency and experience the only requisites for employment in the asphalt paving force.

In his recent annual message, Mayor George P. Codd called particular attention to the results attained with the municipal asphalt plant, and urged further progress along the same lines. In fact, a similar step has been taken with regard to brick paving, contracts having been made for the purchase and erection of a municipal brick plant to

manufacture the brick used for this purpose.

The asphalt plant was secured as the result of a feeling that prices for asphalt paving were far too high for the class of work done, this having gone to the length of a movement to dispense with asphalt altogether. The disposition is now rather the reverse, and the change may be said to be largely due to the city's success with its own plant.

While the average cost per square yard for asphalt re-surfacing was 81 cents during the past season, a cost as low as 71 cents was reached on one street. On another, where the haul was long and there were delays in raising the level of the old concrete, the average ran up to 98 cents per square yard. In all cases where the cost averaged more than 80 cents a yard, the work was done on streets having railway tracks, necessitating the use of more expensive topping material close to the rails.

In comparison with these figures, it may be noted that in contracts for re-surfacing made with private firms in previous years the cost per square yard had ranged from \$1.23 to \$1.45, averaging nearer the latter figure than the former. This in addition to the fact that the contracts had been for long continuous stretches of downtown streets, accessible by short hauls, while the city's re-surfacing was done for the most part on shorter streets scattered about the city and causing a certain amount of waste in time in moving from a completed job to the next one.

Comparative figures as to patching show as large a

margin of saving to the city. The municipal plant had an average cost of 82 cents per square yard for its patching, although the cost of repairing pavements torn up by corporations, plumbers and others ran higher, this being nearly 30 cents cheaper than it had ever been done by contract. In 1901, the Barber Asphalt Paving Company had the patching contract at \$1.33 per square yard; in 1902 the same company contracted to do the work for \$1.14, while in 1903 the Toledo Construction & Supply Company had the contract at \$1.12.

The reduced operating cost of this public plant may be attributed to certain inherent advantages possessed by the municipality, although, as a matter of fact, the municipality must pay slightly more for some of its materials than do the large companies in the business, and its employees are better paid and work shorter hours. On the other hand, the city has a permanent plant on its own property, with a constant amount of work and no long lay-offs between jobs; a force of men working together all the time and thereby getting the best results, with no expense and loss in moving the plant from city to city. The city has to pay no hire of agents and solicitors in getting contracts, and there is no margin of profit to be figured and included in the cost of the paving. A more debateable item is the saving in salaries of city-hired inspectors to watch the laying of the pavement; for inspection of the 62,541 square yards of asphalt re-surfacing on Jefferson avenue, done under contract in 1903 and 1904, the city paid \$1,554.50, or 2½ cents a yard.

A comparison of the cost of brick and asphalt re-surfacing is given below:

Brick (37,777 square yards). Average per yard.. \$1.18
Asphalt (51,250 yards). Average per yard..... .81

The average cost on three large jobs of cedar re-surfacing was 59 cents per square yard. As the wearing life of the wooden pavement is about six years, as compared with ten for the asphalt, the relative cost is somewhat in favor of the latter. Brick patching, in which a large quantity of old material was used, averaged almost exactly the same as asphalt patching, in which only new material was used.

Although comparison between asphalt paving and re-surfacing is difficult, some idea of the relative cost of municipal work and that done by contract during the past year may be obtained. The lowest bid submitted for concreting, binder course and topping on any street was \$1.77, while on other work during the same period bids were made on concrete alone at prices varying from 61 cents to 70 cents. Taking the average, 65 cents, as a figure for laying concrete at a profit, a net price of \$1.12 is left for the binder and topping on contracts, or 31 cents higher than the city paid for re-surfacing by the municipal plant.

In the latter work, wages of the employees ranged from \$3.00 per day for skilled workmen down to \$1.75 per day for common laborers, and the rate for double teams was \$4.00 per day of eight hours. Prices of the materials used follow:

| | | | |
|-------------------|----------------|---------|-------------|
| Asphalt | 1,000 tons | \$22.90 | \$22,900.00 |
| Residuum oil ... | 148.70 tons | 15.18½ | 2,258.03 |
| Sand | 4,733 cu. yds. | 56 | 2,650.59 |
| Binder stones .. | 720.65 tons | .87½ | 3,255.58 |
| Limestone dust. | 566.45 tons | 2.80 | 1,586.06 |
| Coal | 475.22 tons | 2.80 | 1,330.61 |
| Wood | 52.38 cords | 6.30½ | 330.26 |
| Lubricating oil.. | 630 gals. | 11½ | 72.45 |
| Cement | 40 bbls. | 1.38 | 55.20 |

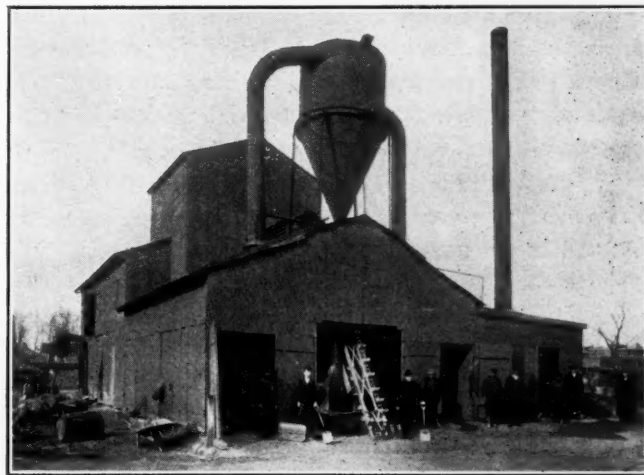
Labor and hauling:

| | | |
|-----------------|-----------|-------------|
| At plant..... | 13,054.13 | \$34,438.78 |
| On streets..... | 8,469.78 | 21,523.91 |
| Total | | \$55,962.69 |

From this may be deducted \$896.99 for materials remaining at the end of the season, leaving a net cost of \$55,065.70.

Adding to the actual cost of re-surfacing ten cents per square yard in lieu of the usual contractor's guarantee, depreciation on plant at 6 per cent. on \$15,500, and an item of \$118.06 as the difference between outlay for new tools, etc., and receipts of the plant from the sale of empty oil barrels, etc., a total cost of \$48,619.73 is obtained for re-surfacing 51,250 square yards, equivalent to 95 cents per square yard, as against \$1.23, the *lowest* contract price for re-surfacing.

The municipal plant began its season July 27 and was shut down November 27. Late in the season the entire plant was rented to a contracting company which had difficulty in completing its contracts and by which 8,000 square yards were laid with the city plant.



THE DETROIT ASPHALT PLANT.

The standard of quality was not lowered in the municipal work. Daily analyses of the mixture were made. The refined asphalt was analyzed whenever a new delivery was made, and hourly sand siftings were taken. The average analysis of the mixture for the season was 10.56 per cent. bitumen. Bermudez asphalt was used and Ohio (Craig) residuum oil. In re-surfacing, 1½ inches of binder and 2 inches of topping were used, while the average in patching was from 2½ to 3 inches of topping.

LITERATURE ON MUNICIPAL TOPICS

Reviews of Some Important Books—Municipal Reports Received

Books

The Book of the Destructor.—11½ inches by 9 inches, 112 pages; copiously illustrated.

The subject of waste disposal is already, if the semblance of a pun may be permitted in this connection, a burning question in many large American cities and threatens to become a matter of urgent importance even for smaller communities. Much theorizing has been indulged in as to the possibility of following, on this side of the Atlantic, the successful practice of British cities in this domain of municipal engineering, but no such term can be applied to the contents of the handsome and in every way creditable volume now before us, presenting the work of Meldrum Brothers, Limited, of Manchester, England, in the installation of destructors for the disposal of refuse of towns and institutions.

The Meldrum Company may claim to rank foremost in this line of work, having installed and under construction a greater number of municipal plants than any other make of destructor in the world. The division of work done by its plants is thus stated in the book:

| | |
|--|----|
| In connection with electricity stations for municipal lighting and railway traction..... | 38 |
| Combined with sewage and municipal sanitary works | 30 |
| Combined with municipal waterworks pumping stations | 2 |
| Independent installations not utilizing power.. | 9 |
| Institutions, hospitals and industrial works.... | 24 |

Of these plants, eighty-three are in Great Britain, the others in Australia, New Zealand, Queensland, South Africa, and two now under construction in this country, i. e., at Sacramento, Cal., and Westmount, Canada.

The book describes the two destructors of this company, the "Beaman and Deas," a combination of two cells with one combustion chamber, being the first twin cell destructor ever placed on the market; the business of the Beaman & Deas Company was amalgamated with that of Meldrum Brothers in 1900. The Meldrum "Simplex" destructor came into use in 1893 and was completed in 1896 by the addition of the Regenerator—the most notable advance in destructor design since the introduction of the original Fryer cell.

The "Simplex" or continuous grate system includes a single long open chamber, divided below the grates into separate ash-pits, to which is applied the forced draft of heated air from the regenerator at a guaranteed temperature of 350° F. The many advantages of this method as compared with others are described and illustrated by diagrams and pictures of operating plants.

In power production and utilization, the results at-

tained by the Meldrum methods are claimed to be unequalled. There are reports of trials and tests made by independent authorities, certified to be exact and accurate; giving a clear idea of the amount of refuse destroyed, the calorific value of the waste, the evaporation of water, the steam power utilized, the volume and analysis of gases, the residuals and their treatment, the costs of operation, and the financial returns as compared with older methods.

These reports, made by the Manchester Steam Users' Association, The National Boiler and General Insurance Company, and many eminent mechanical and electrical engineers, entirely independent and unconnected with the Meldrum Company, are most convincing in their exact details. The book also includes reports from the engineers and surveyors of various towns, giving costs of upkeep and repairs, the uses of the steam, immunity from nuisance, the fulfillment of guarantees, and many other items of information from practical experience. There are descriptions and plates of the smaller sized destructors for hospital and individual uses. The extensive plant of the Meldrum Company at Timperley, near Manchester, is fully illustrated and described.

The Book of the Destructor is something more than a trade publication, inasmuch as it deals with the installations of a company whose business is rapidly extending all over the world in a line of work of international sanitary importance and value. It is of particular interest to municipal and sanitary authorities in the United States as describing apparatus in successful use. This country is now at the point where our British cousins were ten years ago, when they discarded the inefficient low-temperature furnaces burning waste by natural draft with the aid of fume cremators, and adopted the more powerful and efficient high-temperature destructor, with forced draft of regenerated air, and added steam boilers to utilize the heat.

A point of much significance is brought out in the introductory chapter, in which it is stated that loans in connection with the disposal of refuse at sea are discountenanced by the Local Government Board, the English central authority in these matters. Approval of such loans, applied for by local bodies, is granted only when the impossible guarantee is given that no refuse shall return to the shore. Similarly, the Board disapproves of refuse dumping—an attitude which gives an enormous impetus to incinerating methods in a country where reduction processes are unknown.

The book is furnished to THE MUNICIPAL JOURNAL AND ENGINEER by Mr. W. F. Morse, 25 Broad street, New York, the American representative of the Meldrum Company.

British Progress in Municipal Engineering. By William H. Maxwell, Assoc. M. Inst. C. E.—London: Archibald Constable & Co., Ltd.; Chicago: W. T. Keener & Co. $10\frac{1}{2} \times 7$ inches, 182 pages; with many full-page and folded plates. Price \$2.40 net.

"The great mass of the people of Great Britain, down to the accession of Queen Victoria, lived, worked and died under conditions which grossly violated the now well-known principles or laws of health, and the progress of hygiene, such as it was, entirely rested for many ages upon an empirical basis. Earlier progress was hindered by ignorance, prejudice, Government indifference, and internal strife and unrest. The people knew but little, and thought less, of the importance of pure water, food and air, of the necessity for healthy, cleanly dwellings and other such conditions which we now rightly regard as first essentials to health. . . . The Government Inquiry into the health of towns, begun by Chadwick some fifty years ago, led to the appointment of Medical Officers of Health to the different towns, and has done much to diffuse a knowledge of hygiene among the people."

These sentences, forming part of the author's introduction to the present volume, concisely contrast the conditions of the two periods named, and may serve to indicate the scope of Mr. Maxwell's work. For the change from one condition to the other has given rise to the necessity for all that is now known as Municipal Engineering—a comprehensive designation in itself, but still more so when light is thrown upon the various ramifications of the subject by such an effort as must have been involved in the making of this survey, ranging as it does over the entire field. Mr. Maxwell is himself one of those engineers, presiding over the executive department of British cities, who have done so much in relegating rule-of-thumb methods to a well-deserved obscurity, and his selection for the work of preparing this contribution to Mr. Ben Morgan's series of "National Engineering and Trade Lectures" was a fitting tribute to the technical and literary ability of which he had previously given proof.

Mr. Maxwell carries his readers from the early history, of road engineering and maintenance, through the evolutionary processes of modern sewerage and water supply engineering, to the stages at which many branches of civic work, while by no means resting, have found at least a relative surcease of discussion along lines once almost distressingly familiar to the student of hygienic progress. The modern appliances for the purification of water, the treatment and distribution of sewage, the utilization of garbage are but a few of the subjects dealt with in illuminating detail. It is, we think, in these that American readers will find themselves more than remunerated by an investment in a book which admirably summarizes much information otherwise scattered over a bewildering list of publications.

Earthwork Tables. By R. S. Henderson.—New York: The Engineering News Publishing Co., 1905. Paper Back, $12\frac{1}{4} \times 9\frac{1}{4}$ inches, 32 pages. Price \$1.00.

Divided into two parts, this result of much calculating and tabulation gives the cubic yardage per 100 feet for level sections, with varying bases and heights and the volume in cubic yards of prisms 100 feet long by the "average end area" method. The figures are worked out so as to give results with a minimum of interpolation, and the addition of a graphical method of estimating quantities from a profile increases the value of the work both to the student and the busy engineer.

A Review of the Laws Forbidding Pollution of Inland Waters in the United States. Second Edition.—By Edwin B. Goodell. Department of the Interior, U. S. Geological Survey.

The object of this review is to direct public attention to the immense harm being done by the rapidly increasing pollution of inland waters, and to the measures hitherto taken to meet this condition. Under the common law, water flowing over land is part of the realty and belongs to the owner of the soil. This ownership, however, is subject to restrictions; the owner is under obligation to pass the water on in a condition sufficiently allied to its original state as not to injure the riparian owner below. Besides this, the public in general has the right to have inland waters kept free from pollution by such owners or others, in which connection municipalities have the same rights and labor under the same obligations as individual owners. That is to say, they may discharge sewage and surface drainage into the water-course only to such an extent as not to injure property below.

Jurisdiction over the pollution of waters in the United States is confined to the several States, as no constitutional provision was made giving Congress any authority in this province, presumably because the interstate point of view was not at that time of importance. Statutory provisions of the different States vary widely: in some there is nothing but the simple provision making it a crime to poison wells and springs; in others, elaborate provision have been made, designed to check or even prevent all pollution of waters by mingling with them refuse products of animal life or wastes of human industry. Mr. Goodell arranges the anti-pollution statutes enacted by the States in groups, according to the severity of their restrictions; this arrangement is adopted in order to make the information easily accessible to public officials, water companies, manufacturers, farmers and legislators, and enables the reader to turn to the particular section in which his immediate interest lies.

THE CINCINNATI PAY-ROLLS, according to the local *Citizens' Bulletin*, were found, on the recent change of administration, "stuffed with dummies—men whose only occupation was to draw at stated periods a good, round sum from the treasury. And the money thus bestowed upon the idle and worthless represented a tax filched from the hands of honest labor. And there are some people who appear to approve this sort of thing. May it not be the case that they lack the courage to denounce it!"

Personalities

FREDERIC PIKE STEARNS, the new President of the American Society of Civil Engineers, is a personal monument to that force of character and quiet perseverance which enable a man to overcome what would now be regarded as the disadvantage of a non-collegiate training in his chosen profession. Born in Calais, Me., in 1851, he entered the Boston City Surveyor's office in 1869, and found time, amid the engrossing duties of this initial appointment, to embark on a course of study which he would probably be the last to describe as completed even at this late day.

Mr. Stearns was exceptionally fortunate in the class of work with which he was brought in contact and no less so in the men whose pupil and colleague he became. During his lengthy connection with the New England metropolis a phenomenal amount of high-class work has been done by the various Boards and Commissions with which he has been successively connected, and problems of the highest value to sanitary engineering generally have been worked out either under his immediate supervision or with his active co-operation and knowledge. The inception of the Metropolitan Main Drainage system was largely due to his recognition of the difficulties attending individual action by the score of municipalities now united in that undertaking, and, similarly, a far-sighted view of the Metropolitan water situation served in the promotion of what, under other conditions, might have been left for a succeeding generation to do at a much less favorable time and after much ill-considered patchwork in the interval. The earlier failure to convince the Massachusetts Legislature, or rather, certain hide-bound bureaucrats among National harbor authorities, of the feasibility of damming the Charles River in Boston, was followed by a measure under which that important work is now being carried out, Mr. Stearns being Consulting Engineer in connection therewith.

As one of the Advisory Board of Engineers reporting on the Isthmian Canal problem, Mr. Stearns' name has been before the public of late to a greater extent than his naturally retiring disposition has hitherto permitted. His connection with sanitary engineering in Massachusetts is still maintained by his position as Chief Engineer to the Metropolitan Water and Sewerage Board, with special reference to the water undertaking. He is Consulting Engineer to the city of Baltimore in connection with the sewerage scheme now entering upon the constructional stage, and one of the Consulting Engineers to the New York Board of Water Supply.

We tender Mr. Stearns our congratulations on the attainment of the dignity now conferred upon him, together with our good wishes for himself and the Society over which he is to preside during the present year.

WIDE VARIATIONS IN BIDS, of which examples are sometimes cited in this country, are not unknown elsewhere. The construction of a covered reservoir for the Metropolitan Water Board of London elicited thirty-nine bids, ranging between \$1,312,370 and \$665,050.

Buffalo's New Charter

IN a recent communication to the Board of Aldermen, Mayor Adam of Buffalo, N. Y., announces the appointment of members of a New Charter Commission. The Mayor writes:

"The charter of the City of Buffalo is in a deplorable condition. It has been patched and mended and amended until it is a confusing jumble of conflicting enactments and uncertain provisions. This constant tinkering has resulted not only in perplexity and contradiction but in the creation of an unsatisfactory and unbusinesslike system of administering municipal affairs. Our charter was created years ago and many of its provisions are antiquated or out-of-date. Others are half amended. Others by common consent should be abolished altogether.

"It is the intention that out of this conglomeration of legislative acts and counteracts the New Charter Commission shall evolve a complete, coherent, practical plan for a modern and efficient business form of government for our city and by our citizens."

Prominent among the questions to be solved are the provision for future enlargement of the city, including the matter of county boundaries; an efficient system of taxation and collection; the taxation and regulation of public service corporations; the general reorganization of the city departments, and home rule in relation to the State Government.

Arrangements will be made by the Commission for a full hearing from officials and citizens on all matters under consideration; the Mayor will, from time to time, transmit to the Council the result of the Commission's labors, with such recommendations as he may think desirable.

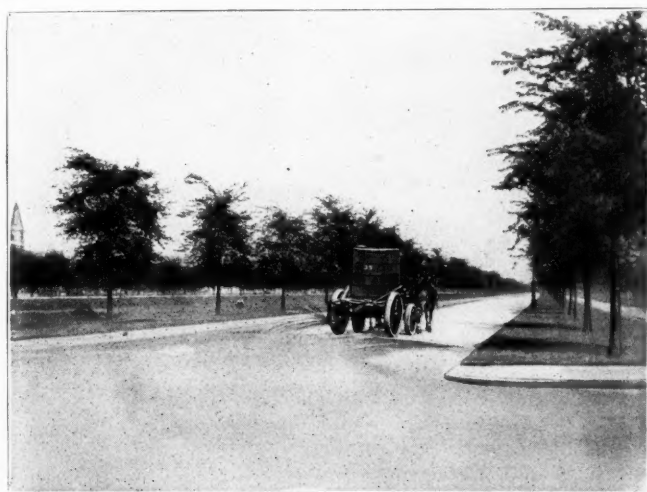
Pending the final discussion of the many questions involved, the Mayor requests the Commission to take up, at its earliest convenience, the matter of legislation for the re-organization of the Police Department, in which something approaching a scandal has been revealed since Mayor Adams' accession to office. He also desires to secure, through the Legislature, a measure giving the Chief Executive power to remove any city official.

THE WATERWORKS OF BERLIN, recently reported on for the year 1904, supply a total population of 1,981,200 persons through 27,806 services, the method of universal meter supply, through single meters to the large tenement buildings which are such a feature of the German capital, accounting for the high average of seventy-one persons supplied per service. Of the total volume delivered during the year, 84 per cent. was paid for, 9 per cent. delivered free and 7 per cent. unaccounted for. The volume paid for represents a gross charge at the rate of 14.5 cents per thousand U. S. gallons. The average consumption per head per day amounted to 22.2 gallons. It is notable that although the winter climate of Berlin is severe the lowest day's consumption, equivalent to 66 per cent. of the daily service for the year, was in December. The highest day's consumption, in July, amounted to 151 per cent. of the same average.

The Dust Nuisance

THE MUNICIPAL JOURNAL AND ENGINEER has frequently directed attention to the increasing dustiness of roads—a condition to which modern innovations in methods of traction have materially contributed. Apart from the inconvenience involved, there is abundant testimony to the injurious effects upon health directly traceable to the inhalation of this irritating and often specifically noxious substance. Pulverized horse-droppings are only one item out of many which account for an evil now widely recognized, and while alleviation of this particular form of pollution is being found in the general replacement of horses by motors, the latter serve to intensify the nuisance in another direction. The use of fresh water, while sufficiently obvious as a remedy, is bound up with drawbacks of two kinds, closely connected with each other. On the one hand, the effect is merely transitory and, on the other, the cost of meeting this by more frequent watering goes to make up a formidable item in a city's accounts.

Sea-water has been largely used in English cities and there was, at first, a general belief that a remedy had been found, in this, not obtainable from the earlier method. The effect is certainly more lasting, and there is probably some preservative effect in the slight crust formed after repeated applications, while from a sanitary point of view there is perhaps a gain due to the slightly antiseptic qualities of sea-water. But the damage to carriage varnish and to goods exposed for sale on or near



Courtesy of the Westrumite Company of America, Monadnock Block, Chicago.

A WESTRUMITED ROAD, SOUTH PARK, CHICAGO

sidewalks soon led to complaints and these, once started, were quickly followed by others. Thus, the crust of salt, dry during favorable weather, becomes moist and sticky under the influence of damp or fog, with resulting damage to roads from "picking up" by horses' feet.

Various other remedies have been tried, notably in Great Britain, and oil has had an extended trial in California. Some of these are referred to on pages 10 and 11 of January monthly number of THE MUNICIPAL JOURNAL AND ENGINEER. The matter has recently received an added impetus in America by the establishment, in Chicago, of a company handling what is perhaps the

best-known of many tried liquids for laying dust. "Westrumite" has, until within a comparatively recent date, been chiefly known by the extensive experiments made with it in European cities and along stretches of main highways, but there is now a possibility of its extended use in a climate calling for a high grade of efficiency in this respect. It is shipped in barrels or tanks, of such strength as to require largely diluting before use, a ten per cent. solution being adequate for first applications. For subsequent sprinklings a five per cent. solution is sufficiently strong, and the intervals between applications appear to increase as time goes on. If this be due to any consolidating or similar preservative action upon the road surface, the material will doubtless possess claims of no ordinary value upon those in charge of roads.

Public Documents Received

Financial Report, Denison, Texas, 1904.

Annual Reports of the Cincinnati City Departments for 1904.

Report of the New York Bay Pollution Commission, May 1, 1905.

Report of Board of Water Supply, New York City, October 9, 1905.

Annual Report, Racine, Wis., for year ended April 17, 1905.

Annual Report, Franklin, N. H., for year ended January 4, 1905.

Annual Report, Winsted, Conn., for year ended May 1, 1905.

Annual Report, Tiffin, O., for year ended December 31, 1904.

Annual Report, Berlin, N. H., for year ended February 15, 1904.

Annual Reports, Columbus, Ga., for year ended December 1, 1904.

Annual Report, City of Easton, Pa., for year ended March 31, 1905.

Annual Report of the Lamp Department, Boston, Mass., for 1904.

Annual Report of the Fire Department, Rochester, N. Y., for 1904.

Annual reports of the City Departments, Cincinnati, Ohio, for the fiscal year ending December 31, 1904.

Journal of the Common Council of Detroit, Mich.:—January 12, 1904—January 10, 1905. 9½ inches by 7 inches; 1418 pages.

The Milk Supply of Boston, New York and Philadelphia.—Bulletin No. 81 of the Bureau of Animal Industry, U. S. Department of Agriculture, Washington, D. C.

Gesundheits-Ingenieur (Munich, December 10, 1905) contains an interesting review of recent works dealing with the presence of *bacilli coli communis* in drinking water, with special regard to its adoption as a criterion of contamination by human discharges. The value of this criterion is warmly disputed among those who have claims to be heard, and the article gives a fair summary of recent utterances in regard thereto.

Articles in Foreign Publications

The Western Municipal News (Winnipeg, Man.), a new candidate for public favor, makes its first appearance in this month's number. An article on "Municipal Bookkeeping," by Wm. Murray, deals concisely with a subject very much to the front at this time, and Mayor Brown, of Portage-la-Prairie, discusses the question of "Municipal Government," with special reference to Canadian conditions. The Editor desires suggestions for "the best English equivalent for 'Municipal'"—a good Anglo-Saxon term being, he thinks, best adapted to the needs of a free community. The new journal has a hopeful work before it as a vehicle for information and discussion in regard to municipal topics in the rapidly developing Provinces of Manitoba, Alberta and Saskatchewan, and our hearty good wishes are with those who have undertaken it.

The Surveyor (London, December 15, 1905) devotes four pages to an illustrated article on "Concrete Mixers," being a paper read by Mr. J. S. Owens before the Mechanical Engineers' Society. Reference is made to the paper read before the American Society of Mechanical Engineers, last June, by Mr. E. N. Trump, in which his ingenious measuring machine was described. A paper on "Improvements in Tramway Trucks," by Mr. Elmer E. Cook, read before the Tramways and Light Railways Association, discusses the relative advantages of bogie and single-truck cars for street railways. The Author favors the radial truck, as combining, in his opinion, the best qualities of both these types.

The Engineering Review (London, December, 1905) gives prominence to an illustrated article on "Conduit Electric Tramway Systems," by J. H. Rider, M. Inst. C. E., Chief Electrical Engineer, London County Council Tramways.

Convention Dates

February

LEAGUE OF MICHIGAN MUNICIPALITIES, Annual Convention, Grand Rapids, February 20-22.—John A. Fairlie, Secretary and Treasurer, Ann Arbor.

SECOND CONFERENCE OF COMPTROLLERS, AUDITORS, TREASURERS and others interested in the uniform classification of municipal accounts and comparable municipal statistics—Arlington Hotel, Washington, D. C., February 13 and 14—L. G. Powers, Chief Statistician, Bureau of the Census, Washington.

March

NEW YORK AND CHICAGO ROAD ASSOCIATION, Annual Convention, Hornellsville, N. Y., March 20 and 21.—William L. Dickinson, Chairman of the Executive Committee, Springfield, Mass.

SOMERVILLE, MASS., has a \$1,000,000 scheme for abolishing railroad grade crossings, twelve persons having been killed in a year and a half at those points.

City Brevities

SACRAMENTO, CAL., proposes the filtration of its water supply.

MACON, GA., which now burns its garbage in the open air, proposes to introduce improved incinerating appliances.

CAMDEN, N. J., has had a meeting of citizens at which a proposal for a municipal lighting plant was enthusiastically received.

TACOMA, CAL., after spending nearly \$2,000,000 on a municipal water system, is confronted with an equal expenditure on a gravity scheme.

LOUISVILLE, KY., is seeking legislation for a new charter, amending defects which have proved detrimental to the effective work of city officials.

BANGOR, ME., has consulted Mr. Freeman C. Coffin, the well-known Boston engineer, in connection with a proposed water supply scheme.

MINNEAPOLIS, MINN., may adopt an amendment to the electric wiring ordinance, providing that all wires in buildings must be run through iron conduits.

CHICAGO, ILL., wants eighty-five-cent gas from the company; the latter stands out for eighty-eight-cent gas, with liberty to buy gas during the next five years.

HARTFORD, CONN., will experiment this year with the oiling of city streets, as a remedy for the dust nuisance. Street Superintendent Hansling has reported on the subject.

SIoux FALLS, S. D., is in the unusual position of having constructed a waterworks plant which a local company now proposes to buy, subject to the city awarding it a franchise.

DALLAS, TEX., City Council has adopted a resolution submitting to the people, at the April election, the creation of an elective commission in substitution of the present form of city government.

TOLEDO, O., is in conflict with the local Garbage Reduction Company, which claims that individual citizens should be prohibited from disposing of garbage otherwise than through the city collection.

KANSAS CITY, Mo., proposes reductions of 8 to 10 per cent. on water rates—meter and flat—with a minimum charge of seven cents per thousand gallons, in place of five cents. The city owns the works.

CLEVELAND, OHIO, proposes to take the entire business of refuse collection into its own hands; a health regulation will prohibit any but city teamsters from hauling junk, ashes and rags through the streets.

NEW YORK CITY finds it necessary, for the first time in twenty years, to offer a higher rate of interest for loans. Four per cent. is to be the rate on an issue of \$20,000,000 to be sold by Comptroller Metz, February 15.

NORFOLK, VA., is "rejuvenating" its Municipal League; it is desired to bring its membership up to five hundred citizens, interested in "an efficient, non-partisan and business-like administration of the affairs of the municipality."

THE FEDERAL BUILDING, INDIANAPOLIS

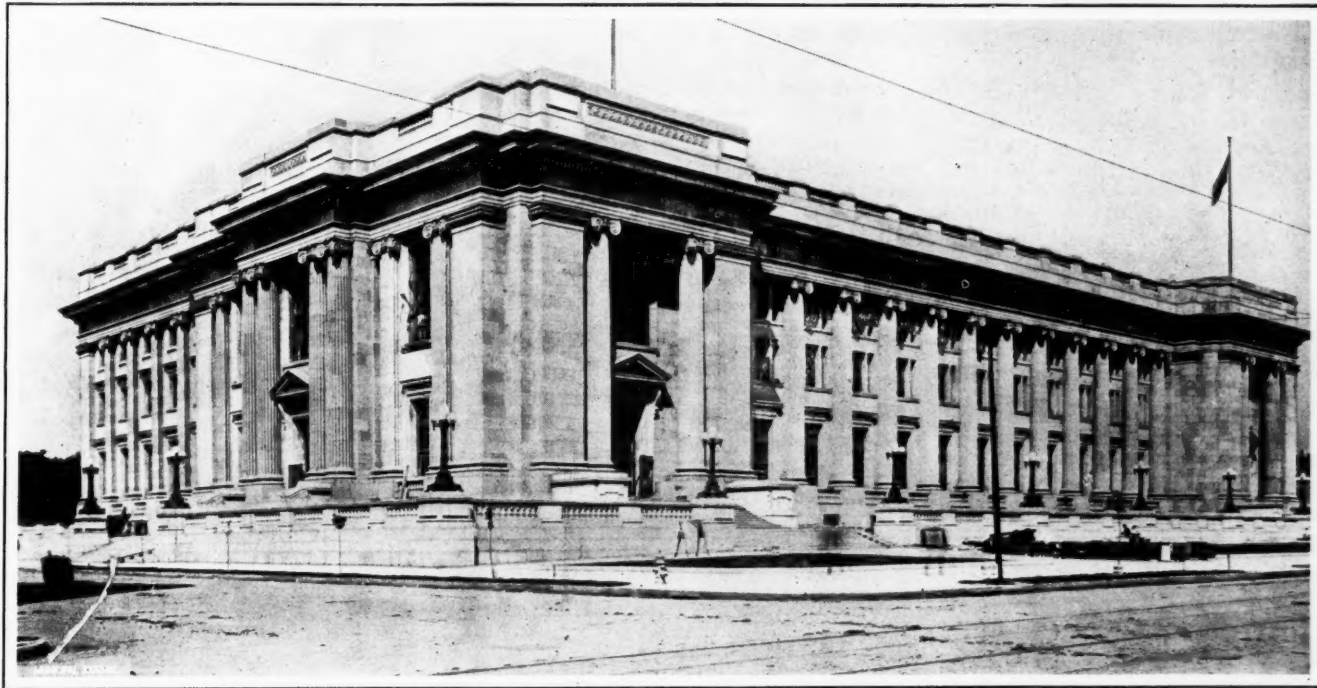
FEW cities in the United States can boast of so handsome a building as the new Post Office and Court House now nearing completion at Indianapolis. From an architectural standpoint, the structure is impressive and an effect of classic beauty has been obtained by the use of Indiana limestone. The building and its site, when all the work has been finished, will represent an expenditure of \$2,500,000.

The interior is ornate with different kinds of marble, of domestic and foreign origin, and a goodly fortune has been spent on the stone inlaid floors and the vari-colored mosaic ceilings in the corridors on the three main floors. Two broad self-supporting stairways form conspicuous features of the building; these describe graceful semi-circles between the floors and visitors to the building, looking up at them, wonder how they are held in place.

provided for on the third and fourth floors. The construction of the building is such that, from the outside, it does not appear to have more than three floors. Special attention has been given to secure the best of lighting and ventilation facilities.

Extensive bathroom accommodations, including shower and tub equipment, have been provided in the basement, which is really on the ground level. This is, in fact, a model public building in every respect. Adjoining the baths are club and lounging rooms, with library and reading rooms for the accommodation of clerks and mail carriers. Similar quarters for the railway mail clerks are located on the top floor of the building. A force of two thousand men will work in and about the building.

What is known as the underground railway runs through the whole building. It is an unusual adjunct,



THE FEDERAL BUILDING, INDIANAPOLIS

Lovers of decorative art will find much in the walls and ceilings of the different rooms and offices to please them, the bronze work in the courts being among the finest to be found in any public building in the United States.

While seeking to make the building attractive, nothing has been sacrificed which would contribute to the convenience of those for whose accommodation it is designed. The Post Office is on the first floor, and the United States Judges and Commissioners holding court in the city have been placed on the second. The pension offices and other miscellaneous bureaus connected with the National government, such as Civil Service and Internal Revenue, are

so adroitly worked into the construction of the walls and ceiling that the observer fails to notice it. Winding its way through the different rooms where postal employees are at work, it affords points of vantage from which inspectors can view the work in progress, and gives the secret service staff the necessary facilities for detecting wrong doing.

The building stands in the middle of a full city block, bounded by four wide thoroughfares—the north elevation facing University Park. It takes the place of a dingy little building erected in 1858, when the population of the city was 20,000, one-tenth of its present figure.

MAYOR MYERS, OF SAVANNAH, GA., welcomed ten thousand callers in the new City Hall on the second day of the year, and was warmly congratulated upon the appearance of the completed building.

A RESERVOIR IN SOLID ROCK is being formed at Bowling Green, Ohio, under the directions of the local Water Works Company. It is to be 100 feet square and 22 feet deep and will be covered.

THE WEEK'S CONTRACT NEWS

RELATING TO MUNICIPAL AND PUBLIC WORK—THE CONSTRUCTION FIELD—PROPOSALS AND CONTRACTS—
SEWERAGE AND WATER SUPPLY, STREET IMPROVEMENT AND LIGHTING—FIRE EQUIPMENT—
BUILDINGS

STREET IMPROVEMENTS

Little Rock, Ark.—The City Council will let contracts next month for three miles of street paving; estimated cost, \$170,000.

Belleville, Ill.—Plans are being prepared for paving and sewer work, to cost \$170,000.—L. L. Harper, City Engineer.

Granite City, Ill.—Bids will be invited shortly for one mile of brick paving; cost, \$30,000.—Edmund Hall, City Engineer.

Lincoln, Ill.—Ordinances have been passed providing for paving three streets, to cost \$16,000.

Shreveport, Ind.—Bids will be opened, February 13, for paving 8,000 yards of streets with asphalt, brick or other material.—C. G. Rivers, Comptroller.

Emporia, Kan.—The City Council has decided to pave a portion of Sixth avenue.

Independence, Kan.—Bids will be opened, February 13, for paving and curbing, 3,200 feet of Tenth street.—T. N. Sickels, City Clerk; Joseph S. Barnwell, City Engineer.

Leavenworth, Kan.—The City Council will have a forty-foot road built from the center of the city to Lansing.

Oskaloosa, La.—Bids for paving over 3,000 square feet with vitrified brick, will be opened, February 12.—Richard Burke, City Clerk.

Boston, Mass.—The contract for surfacing a section of State highway at Lynn, Mass., has been awarded to R. F. Hudson, Melrose, Mass., for \$22,944.

Lynn, Mass.—A petition has been presented to the Legislature for the construction of a 70-foot boulevard from Revere to Lynn at a cost of \$100,000.

Grand Rapids, Mich.—Bids will be invited shortly for paving Stocking street with brick.—L. W. Anderson, City Engineer.

Manistee, Mich.—Bids for paving River and Smith streets with brick, bitulithic or macadam, will be opened March 1; estimate, \$39,000.—George B. Pike, City Engineer; C. A. Gnewuch, City Clerk.

Red Jacket, Mich.—Bids, for paving various streets, will be opened, February 15.—N. F. Kaiser, Village Clerk (P. O. Calumet).

Minneapolis, Minn.—Bids will be opened, February 23, for resurfacing 100,000 square yards with asphalt.—Andrew Rinker, City Engineer.

St. Charles, Mo.—Hill on Adams street will be cut through and street graded and

macadamized; cost, \$14,000.—Carr Edwards, City Engineer.

St. Louis, Mo.—The Board of Public Works is considering a proposition to improve the territory north of Forest Park and west of De Boliviere avenue. It is also proposed to abolish a number of grade crossings.

Great Falls, Mont.—Bids will be opened, February 19, for furnishing material and repaving a portion of Central avenue.—W. P. Wren, City Clerk.

Albany, N. Y.—It is reported that bonds for \$7,000,000 for road improvement and construction will be issued this year.

Buffalo, N. Y.—Bids will be opened, February 15, for repairing portions of six streets.—Francis G. Ward, Commissioner, Department of Public Works.

New Brighton, S. I., N. Y.—Bids for furnishing material, curbing and gutter, paving a portion of Nicholas street, will be opened, February 19.—George Cromwell, President, Borough of Richmond.

Barnesville, Ohio.—Proposals will shortly be opened for furnishing quantities of limestone for constructing the Barnesville and Hendrysburg highway.

Canton, Ohio.—Bids for \$25,000, five per cent. bonds will be opened, February 24, for the improvement of Second street, Walnut street and Wade street; also \$825 bonds for lateral sewer improvement in Center street.—Armstrong Ashbrook, City Auditor.

Cleveland, Ohio.—A new road may be constructed between Cleveland Heights and New Burgh Township.

Columbus, Ohio.—It is reported that bonds for \$35,000 will shortly be issued for street improvements.

Delaware, Ohio.—Proposals are asked, until February 14, for the purchase of Delaware County road bonds.—A. S. Conklin, County Auditor.

Findlay, Ohio.—The ordinance for paving Center street, at an estimated cost of \$9,000, has been approved.—J. C. Edie, Clerk, City Council.

Fostoria, Ohio.—Bids for \$11,500, four per cent. street and sewer bonds, will be opened, March 1.—G. T. Yant City Auditor.

Toledo, Ohio.—Proposals are invited, until February 14, for improving Spencer street; also for paving portions of Metler and Roslin streets. The improvement of Utica street is being considered.—Reynold Voit, Secretary, Board of Public Service.

Youngstown, Ohio.—It is reported that bonds will shortly be issued for improving West Federal street, Wick avenue, Cliff street and other thoroughfares.—William I. Davies, City Auditor.

Altoona, Pa.—Bids for paving about 890 yards on Lexington avenue with vitrified paving brick on a six-inch Portland cement foundation, will be opened, February 14.—Andrew Kipple, Chairman, Board of Public Works.

Warren, R. I.—Over one-and-a-half miles of State road will be built during the coming season.—Joseph B. Hoar, President, Town Council.

El Paso, Texas.—A number of streets will shortly be paved at a cost of \$75,000.

Houston, Tex.—Bids will be opened, February 14, for paving about three-and-a-half miles on two roads.—J. B. Ashe, County Auditor.

Newport News, Va.—In connection with the item, in this column of our issue of January 24, concerning a proposed bond issue of \$100,000, the name of W. T. Brooke was inadvertently given as City Engineer. It should have been T. E. Pearse.

Chehalis, Wash.—Chehalis avenue will be paved with asphalt and other streets with brick or asphalt.

Seattle, Wash.—A majority petition has been presented to Council for regrading Pine street, et al., at an estimated cost of \$82,000.

Green Bay, Wis.—Bids will be invited shortly for 38,000 yards of asphalt paving and 11,500 yards of vitrified brick paving.—W. W. Read, City Engineer.

SEWERS

Cloverdale, Cal.—Bids for constructing a sewer system will be opened, February 27.—George W. Coe, President, Board of Trustees.

Vacaville, Cal.—The citizens will vote on issuing bonds for a sewer system, February 20.

Hartford, Conn.—Bids for constructing the New Britain sewer will be asked about March 1.—F. L. Ford, City Engineer.

Jacksonville, Fla.—Bids will be opened, March 5, for constructing cast-iron and terra cotta sewers, and brick and terra cotta drains.—B. F. Dillon, Chairman.

Belleville, Ill.—An ordinance is being considered for constructing sewers in Highland addition; estimated cost, \$10,000.—L. L. Harper, City Engineer; Fred J. Kern, Mayor.

Joliet, Ill.—Specifications will be ready in April for tile sewers, to be constructed throughout the city; cost, \$100,000.—H. A. Stevens, City Engineer.

Waukegan, Ill.—Specifications are being prepared for five miles of vitrified pipe sewers and four miles of 60 x 24-inch concrete sewers.—M. K. Miller, City Engineer.

Lawrence, Ind.—Bids will be opened, February 24, for constructing a sewer system and sewage purification plant.—Capt. B. F. Cheatham, Constructing Quartermaster.

Burlington, Iowa.—Citizens will vote, March 5, on resolutions for constructing 12,000 feet of sewers, and bids will be invited about March 25.—William Steyn, City Engineer.

Storm Lake, Iowa.—Contracts for the proposed sewer system will be let in about sixty days.—Iowa Engineering Company, Clinton, Engineers.

Attleboro, Mass.—The city will construct a drain and improve sewers at a cost of \$5,000.

Beverly, Mass.—The city may expend \$20,000 enlarging the sewer system.—William J. Berry, City Engineer.

Brockton, Mass.—The city will shortly lay 4 miles of pipe sewers at an estimated cost of \$40,000. It is also proposed to construct a surface drainage system, to cost \$10,000.

Milford, Mass.—Plans for a sewer system are being prepared by D. W. Pratt, representing E. W. Bowditch, Boston.

Taunton, Mass.—The city will lay 3,000 feet of 40-inch sewer at an estimated cost of \$30,000 and 2,000 feet of smaller sewers.—A. K. Crandell, City Engineer.

Newark, N. Y.—Plans for a sewer system have been made and about twenty-one miles of pipe sewer will be purchased.—Charles Kelley, Engineer.

New York, N. Y.—Proposals are invited, until February 13, for constructing an intercepting sewer in Richmond Terrace, Nicholas street to Westervelt avenue.—George Cromwell, President, Borough of Richmond.

New York, N. Y.—The contract for constructing sewers in One Hundred and Ninety-second and other streets was awarded W. J. Brennan for \$83,102; also for sewers in Bronx, \$25,699.

Lexington, N. C.—The time for receiving bids for a sewer system has been extended to February 22.

Cincinnati, Ohio.—Bids will be opened, February 16, for constructing a box culvert in Miami township.—C. C. Richardson, County Auditor.

Cleveland, Ohio.—Bids will be opened, February 14th, for masonry abutments in Brecksville, Royalton and Independence; for earth and rip-rap filling in Mayfield; for a masonry arch at Euclid, and masonry culverts at Solon, Euclid and New Burgh.—William H. Evers, County Engineer; Julius C. Dorn, Clerk, Board of County Commissioners.

Dayton, Ohio.—The ordinance for building sanitary sewers in local district No. 14 has been approved.—C. P. Floyd, City Clerk.

Altoona, Pa.—Bids will be asked in April for constructing an 800-foot section of reinforced concrete storm sewer; estimate, \$16,740.—Harvey Linton, City Engineer.

Central Falls, R. I.—The city will shortly construct new sewers at a cost of \$10,000.—William F. Keene, City Engineer.

Spokane, Wash.—Plans are being prepared for a main trunk sewer with twenty-nine lateral sewers in the First Ward.—Charles McIntyre, City Engineer.

Wheeling, West Va.—The citizens of Mechin will shortly vote on the question of building a sewerage system.

Toronto, Ont.—Bids will be opened, March 6, for constructing a sewer system in territory east of Woodbine avenue.—Emerson Coatsworth, Mayor, and Chairman, Board of Control.

WATER SUPPLY

Grass Valley, Cal.—The water system will be improved and larger mains laid.

Los Angeles, Cal.—Plans are about ready for extending the waterworks. The new source of supply will be mountain streams, 240 miles distant. The total cost will approximate \$23,000,000.

Buena Vista, Ga.—Bonds for a water system have been sold and bids will be invited shortly.

Clarksville, Ga.—It is proposed to build waterworks. Preliminary plans are being prepared.—Robert McMillan, Chairman, City Committee.

Lee, Ill.—The Village Board proposes to install a meter system.

Parkridge, Ill.—Bids will be opened, March 6, for constructing a 100,000-gallon water tank.—C. M. Miller, Chicago, Engineer.

Rock Island, Ill.—Bids will be opened, February 12, for constructing an addition to the waterworks building.—H. C. Schafer, City Clerk.

Lawrence, Ind.—Bids will be opened, February 24, for constructing a water distributing system; 200,000-gallon, reinforced concrete reservoir; 300,000-gallon steel tank and trestle, boilers, feed pumps, injectors, air compressors, pumps, condenser, piping, etc.—Capt. B. F. Cheatham, Constructing Quartermaster.

South Bend, Ind.—Plans and surveys have been completed by the South Bend Power Company for constructing a dam in the St. Joseph river, to cost \$500,000; also for a new power house.

Marlow, I. T.—Bonds, \$20,000, have been voted to construct a water system.

Delmer, Iowa.—The waterworks will be improved to afford better fire protection. An election may be held to authorize a bond issue.

Montezuma, Iowa.—Bonds, \$5,000, have been voted to improve the water system.

Tonganoxie, Kan.—Bonds for \$15,000 will be issued for building waterworks. Preliminary plans have been prepared.

Farmington, Me.—Village will issue \$30,000 bonds to extend water system by taking its supply by gravity system from Varnum Pond.

Brockton, Mass.—Preliminary plans are being prepared for improvements at the waterworks to increase pressure. The cost will approximate \$125,000.—Charles R. Felton, City Engineer.

North Chelmsford, Mass.—A Legislative bill provides for water system in connection with system of Lowell; cost, \$25,000.—James Dunnigan, Selectman.

Calumet, Mich.—The question of installing water meters is being considered.

Bovey, Minn.—The Village Council has voted to establish a municipal waterworks system.

Chillicothe, Mo.—The citizens have voted \$100,000 bonds for a municipal water and light plant.

Fayette, Mo.—Bids for \$46,000, four-and-a-half per cent. water bonds have been rejected and new bids will be opened, February 12.

Henderson, Neb.—The citizens will vote on proposition to issue bonds for waterworks, February 13.

Woodville, N. H.—The question of a water system for 2,000 people is being considered.—C. P. Barney.

Albuquerque, N. M.—The citizens will vote on issuing bonds to purchase waterworks.—Pitt Ross, City Engineer.

Brooklyn, N. Y.—The Board of Estimate has authorized an appropriation of \$500,000 for maintaining and extending water supply.—W. B. Ellison, Commissioner, Water Supply, Gas and Electricity.

Brooklyn, N. Y.—Bids will be invited shortly for installing 1,000 new hydrants.—W. C. Cozier, Deputy Commissioner, Water Supply, Gas and Electricity.

Lockport, N. Y.—Plans are being prepared for obtaining increased water supply from the Niagara river. The matter will shortly be presented to the State Water Commission. A large expenditure will be required.

Lyon Falls, N. Y.—The State Board of Water Supply is considering the construction of a water system.—Frank Hoskins, Village President.

Watervliet, N. Y.—Water system costing \$250,000 may be built. Water will be brought seven miles from Crescent in twenty-inch pipe.—F. B. Durant, Water Commissioner.

Cincinnati, Ohio.—Bids will be opened, February 20, for the generating machinery in the eastern pumping station.—A. Herrman, President, Board of Public Works Trustees.

Lima, Ohio.—Proposed improvements to the waterworks will shortly be undertaken. Preliminary plans have been prepared.

Lorain, Ohio.—Proposals are asked, until February 12, for furnishing 120 tons of

6-inch iron pipe, the material to be delivered April 1.—Custer Snyder, Clerk, Board of Public Service.

Medina, Ohio.—The problem of an adequate water supply is being discussed. A city committee is considering plans for municipal waterworks.

Painesville, Ohio.—The city officials are considering the proposed installation of sand filters at a cost of \$25,000. The people may vote on the question of issuing bonds.

Perry, O. T.—The citizens have voted to issue \$25,000 bonds for improving the water system.

Erie, Pa.—The city will probably erect a filtration plant upon the completion of the intake.—B. E. Briggs, City Engineer.

Meadville, Pa.—A bond issue for \$10,000 may shortly be authorized for improving the waterworks.

Providence, R. I.—Contracts were awarded, January 24, for laying water mains from Sockanosset reservoir to the city, as follows:—Section 1, Frank A. Gammino; Section 2, Bruno, Salomone & Pettitti; Section 3, Frederick E. Shaw; Section 4, Charles Crankshaw. The total cost will be \$60,000.

Knoxville, Tenn.—The City Council is considering a proposed bond issue for improving the waterworks.

Sherman, Tex.—Bids will be opened, February 19, for constructing a steel stand-pipe.—Henry Zimmerman, City Clerk.

Norfolk, Va.—The City Council will petition the Legislature for authority to issue \$500,000 in bonds for the erection of improved waterworks.—W. T. Brooke, City Engineer.

Richmond, Va.—A \$20,000 filtration plant, to furnish the city with 1,000,000 gallons per day, will be built.—W. E. Cutshaw, City Engineer.

Riverside Park, Va.—Bids will be opened, February 16, for extending the water system at Fort Washington.

Centralia, Wash.—A committee has been appointed to consider waterworks improvements.—J. E. Lease.

Seattle, Wash.—The Superintendent of the Waterworks recommends the perfection of the meter system.

Tacoma, Wash.—The city will expend \$2,000,000 improving the water system by supplying a gravity supply from Green or Greenwater rivers, thirty to thirty-five miles east of Tacoma.

Vancouver, Wash.—A franchise for building waterworks has been granted J. A. P. Ford and F. L. Purse.

St. Croix Falls, Wis.—The City Council is considering establishing a water system.

Meeteetse, Wyo.—Bonds have been sold for constructing a waterworks plant.

Woodstock, Ont.—The Water and Light Commission will ask for bids shortly for constructing a reinforced concrete reservoir 100 feet in diameter, 30 feet high.—G.

C. Eden, Secretary; F. J. Ure, City Engineer.

Amherst, N. S.—An estimate of \$400,000 has been made by Snow & Barbour, Engineers, Boston, Mass., as the cost of a gravity water system from the Macaan river.

PUBLIC LIGHTING

Carbon Hill, Ala.—A city committee recommends the erection of an electric-light and power plant. Bids will shortly be asked.—J. S. Shannon, Chairman, Committee.

Montgomery, Ala.—The plant of the Citizens' Light, Heat and Power Company will shortly be enlarged and improved at a cost of \$50,000.—P. R. Whiting, Manager.

Green Forest, Ark.—The Town Council is considering an application of John Odell for an electric-light franchise.

Springdale, Ark.—Plans have been completed for an electric-light plant.

Georgetown, Colo.—Proposals will be invited in March by the East Argentine Mining Company for constructing an electric power plant; estimated cost, \$400,000.

Adel, Ga.—The proposed erection of an electric-light plant is being considered; estimated cost, \$6,000.

Clarksville, Ga.—The city may shortly construct an electric-light plant.—Robert McMillan, Chairman, Councils' Committee.

Marietta, Ga.—A franchise for 50 years to build and maintain a gas plant has been awarded Arthur R. Law, Philadelphia, Pa.

Freeport, Ill.—The City Council has accepted the bid of the Freeport Railway, Light & Power Company for lighting the streets for five years.

Fort Wayne, Ind.—The Kerr Murray Manufacturing Company will shortly begin the erection of a new electric power plant.

Wynnewood, Ind. Ter.—Proposals are asked, until February 14, for constructing an electric-light plant and distribution system.—J. O. Swingley, Mayor; W. P. Bullock, Engineer.

Lincoln Center, Kan.—Plans are being prepared for constructing the proposed municipal electric-light plant.—W. K. Palmer, Consulting Engineer, Kansas City, Mo.

Cloverport, Ky.—The City Council is considering an application for a franchise to build and operate an electric-light plant. D. Stewart Miller, Owensboro, Ky., is behind the project.

Covington, Ky.—A City Committee is considering the proposed erection of a municipal electric-light plant. Bonds for \$75,000 may be issued.

Winnfield, La.—A franchise to erect and operate an electric-light plant has been granted the Winnfield Electric Light and Power Company.

Hyattsville, Md.—An election will shortly be held to determine the question of issuing bonds for building a municipal electric-light plant.

Boston, Mass.—The City Council is considering the proposed building of a mu-

nicipal electric-light plant.—William Jackson, City Engineer.

Corinth, Miss.—The city has granted a franchise for maintaining an electric-light plant to W. J. Lamb, M. T. Bynum and A. Rubel, of Corinth.

Grand Island, Neb.—Plans and specifications have been prepared for a combined electric-light plant and water system, the total cost to be approximately \$50,000. An election will be held March 6 to determine the question of issuing bonds.—Henry Schuff, Mayor; W. K. Palmer, Kansas City, Mo., Consulting Engineer.

Orange, N. J.—Proposals will be received, March 1, for lighting the streets for both three and five years.—F. T. Crane, City Engineer.

Paulsboro, N. J.—Plans are being prepared for constructing a gas plant.

Buffalo, N. Y.—Plans are being prepared for constructing a municipal electric-light plant. Bonds may be issued.

Columbus, Ohio.—The Board of Public Works is considering improvements for the municipal electric-light plant; estimated cost, \$83,000.—Julian Griggs, Chief Engineer, Board of Public Works.

Mt. Vernon, Ohio.—It is proposed to issue bonds for constructing a municipal electric-light plant.

Stroud, Okla.—Bonds for \$4,000 will be issued for building an electric-light plant.—James P. Freshour, City Clerk.

Meadville, Pa.—It is proposed to issue \$15,000 in bonds for improving the electric-light plant.

Pinegrove, Pa.—The question of erecting a municipal electric-light plant is being considered. An election may be held to decide the matter.

Salt Lake City, Utah.—It is proposed to build three electric power stations near Salt Lake City. The Inter-Mountain Power Company will undertake the work at a cost of \$500,000.—Frank C. Kelsey, Salt Lake City, Engineer.

Burlington, Vt.—The Winooski Town Trustees have granted John R. Dawson, Boston, Mass., a franchise to construct and operate a gas plant.

Norfolk, Va.—The Norfolk Ice & Cold Storage Company has preliminary plans for constructing an electric-light plant, to cost \$1,000,000.

Richmond, Va.—The question of building a municipal electric-light plant is still under consideration.

FIRE DEPARTMENT SUPPLIES

Fresno, Cal.—The Fire Chief recommends the purchase of a fire engine and 1,000 feet of hose.

Kendallville, Ind.—The city is considering the purchase of a fire alarm system, hose wagon, hose nozzles, extinguishers, ladders and other apparatus.—James Graves, Mayor.

Sterling, Kan.—The City Council will reorganize the Fire Department, and new apparatus will be purchased.